PREVALENCE OF ORAL MUCOSAL LESIONS OF THE GERIATRIC PATIENTS IN DENTAL HOSPITAL, NARESUAN UNIVERSITY

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A Thesis Submitted to the Graduate School of Naresuan University
in Partial Fulfillment of the Requirements
for the Master of Science Program in Dentistry
April 2017

Thesis entitled "Prevalence of Oral Mucosal Lesions of the Geriatric Patients in Dental Hospital, Naresuan University"

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has been approved by the Graduate School as partial fulfillment of the requirements for the Master of Sciences Program in Dentistryof Naresuan University

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25 APR 2017

ACKNOWLEDGEMENT

This research was supported by Faculty of Dentistry, Naresuan University. The authors would like to thank Associate Professor Pensri Phothipakdee, Faculty of Dentistry, Khon Kaen University; Assistant Professor Dr.Patcharaphol Samnieng, Faculty of Dentistry, Naresuan University; Dr.Jadesada Palasuk, Faculty of Dentistry, Naresuan University, for valuable discussion.

Lastly the author would like to thank Miss Pinnara Wongviriya, for beautifully grammatical approving.

Adjabhak Wongviriya

Title	PREVALENCE OF ORAL MUCOSAL LESIONS OF THE GERIATRIC PATIENTS IN DENTAL HOSPITAL, NARESUAN UNIVERSITY
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Academic Paper	Thesis M.S. in Dentistry, Naresuan University, 2016
Keywords	oral mucosal lesion, elderly, Thailand

ABSTRACT

Nowadays, the population of the elderly in Thailand is increasing. This elevating proportion this kind of patient caused the higher number of oral disease including dental caries, periodontal disease and also oral mucosal lesions. The purposes of this study was to determine an association between the prevalence of oral mucosal lesions and variety of variables including age, gender, medical conditions, smoking, alcoholic consumption, areca nut chewing and denture wearing. Intraoral examination and diagnosis were done according to the World Health Organization (WHO) 1980 guideline. From a total of 211 patients, there were 82 patients who had no oral mucosal lesion while the other 129 (61.1%) had at least one oral mucosal lesion. In the present study, oral mucosal lesions were classified into eight groups including oral infection, autoimmune disease, epithelial pathology, vascular lesion, pigmented lesion, exophytic lesion, mucosal injury and other. In the Naresuan University dental hospital, the prevalence of oral mucosal lesions among the geriatric characterized by having more types of lesion. Determining the association between the prevalence of oral mucosal lesions of geriatric patients could not be done since the number of sample who had lesion per each group was not enough for determining the association statistically or it would have high risk of bias. However, there were some group lesions which had higher prevalence among female, male, those who had systemic disease, and those who used medicine and those who wore denture proportionally.

ABBREVIATION

DIF	=	Direct immunofluorescent
MMP	=	Mucous membrane pemphigoid
MMSE	=	mini-mental state examination
OLP	=	oral lichen planus
PAHs	=	polycyclic aromatic state
PV	=	pemphigus vulgaris
WHO	=	world health organization

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CHAPTER I

INTRODUCTION

Rationale for the study

Currently, because of advanced medical technology together with the increasing growth rate since the Baby Boom, the number of the elderly is elevating. Several national health organizations worldwide aware of this group of patients since their proportion has been rising. According to the geriatric survey of the World Health Organization in 2013, Thailand ranked 63rd with 14.3% of geriatric population (The United Nations Fund for Population Activities, 2013). Thai National Health Survey 2014 reported that the geriatric population was increasing as well. In 1994, the proportion was about 6.8% and it was still increasing every year. Finally, it reached 15.3% in 2014 (Institute for Population and Social Research Mahidol University, 2014).

When becoming the geriatric, they become more sensitive because they tend to have impairment immune function; more systemic diseases and tendency of medication complications; longer time of irritation from environment; and more risk factors than those younger (World Health Organization, 2015).

Not only general health that is affected by aging, but also does the oral health. There are many previous studies showed that when becoming older, most of the people do have a change in their oral cavity. The geriatric have more oral mucosal diseases than those younger (Scott, & Cheah, 1989). Thus, aging alone is not an initiating factor of oral mucosal diseases. It needs other factors in combination to cause lesion such as systemic disease, medication usage and also denture wearing (Wolff et al., 1991). Lesions in oral cavity of the elderly, mostly, are benign conditions (Nevalainen, Narhi, & Ainamo, 1997), but sometimes premalignant and malignant lesions can be found. Oral cancer can commonly be found in the patient who is middle adult to seventh decade of life for both genders (Fedele, Jones, & Niessen, 1991). It is given the reason as they have long-term exposing to the environment (Desai, & Yung, 2011) and some of them also have longtime of risky behavior than the others such as

smoking; alcoholic beverage consumption; and in some regions, do have areca nut chewing (Humans Organization, & Cancer, 2004; Centers for Disease Control and Prevention, 2011).

From the abovementioned, there are many factors which contribute the present of oral mucosal lesion including age, gender, medical conditions, oral habits and denture wearing. Moreover, there are a few studies about the prevalence of oral mucosal lesions in the geriatric globally, and only two studies conducted in Thailand. One based on biopsy and microscopic examination in the elderly who were 65 years old or above (Dhanuthai et al., 2015). The other one was a clinical-base studies, totally in Oral Diagnostic Clinic at Chulalongkorn University, Thailand, but was done since 2002 (Jainkittivong, Aneksuk, & Langlais, 2002). Then this study aims at evaluating the prevalence of oral mucosal lesions in the geriatric who attend the Naresuan University dental hospital, Thailand, together with determining its association with age, gender, medical conditions, oral habits and denture wearing.

Purpose of the study

To determine the association between the prevalence of oral mucosal lesions of geriatric patients who attend the Naresuan University dental hospital, Thailand with age, gender, medical conditions, oral habits and denture wearing.

Significant of the study

1. Knowing the prevalence of oral mucosal lesions of patients who are 60 years old or above and attend the Dental Hospital, Naresuan University.

2. Knowing the association of oral mucosal lesions with age, gender, medical conditions, oral habits and denture wearing.

3. The result of this study will be evidence base of oral mucosal lesions in Dental hospital, Naresuan University which would help prepare staffs, equipment and treatment planning for this group of patients.

Scope of the study

This study will determine the prevalence of oral mucosal lesions in patients who are 60 years old or above and attend the Dental Hospital, Naresuan University

and also the association of these lesions with age, gender, medical conditions, oral habits and denture wearing.

Every subject will be interviewed and checked their dentures. Then their information will be collected–age, gender, medical conditions, oral habits and denture wearing. Also, their oral mucosa will be examined by examiner. All data will be categorized into groups. Finally, associations between each group will be determined statistically.

Hypothesis

H_0: Oral mucosal lesions of elderly patients are not associated with age, gender, medical conditions, oral habits and denture wearing.

H_1: Oral mucosal lesions of elderly patients are associated with age, gender, medical conditions, oral habit and denture wearing.

CHAPTER II

REVIEW LITERATURE

Current geriatric situation

Since current world medical technology is more effective and comprehensive, human life spans and the trend of aging society becomes important and worth consideration. It is predicted that in the year of 2011 and 2030 the first and the last baby boomers will reach the age of 65 (Glick, 2015). Thailand also had Baby boom age. It was in 1963-1983 which birth rate was increasing from 600 thousand per year to one million per year.

In 1950, Thailand was aware of this point after World Health Organization had reported the aging country ranking in Southeast Asia which Thailand ranked seventh of the most aged country with 5% of population aged 60 years old or above. The prevalence of the elderly in Thailand is still increasing and moving up to be the second most aged country in this region, after Singapore. According to the latest report of World Health Organization 2013, Thailand is in the 63rd rank of the world (The United Nations Fund for Population Activities, 2013).

In Southeast Asia, there is a study that compares means of aging population in Thailand and other countries in Southeast Asia and also predicts the number of population in very a next year. It presents that Thailand will have higher geriatric population than other countries since 2000 and will continue increasing at this rate until 2050 as presented in **Figure** 1 (The United Nations Fund for Population Activities, 2006).

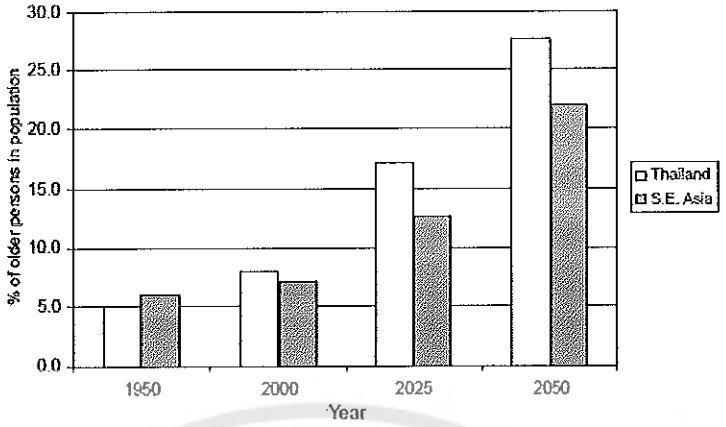

Figure 1 Chart of elderly population in Thailand and other Southeast Asian countries

Source: Institute for population and Social Research, Mahidol University, Population Projects for Thailand, 2005-2025, 2006; Unites Nations, Deparment of Economic and Social Affairs Division, Word population ageing 1950-2050, Population Division, New York, 2002.

From Thai National Health Survey 2014, it was reported that the geriatric population in Thailand was rising as it had been predicted. From 6.8% in 1994, the proportion elevated every year and finally reached 15.3% in 2014 (Institute for Population and Social Research Mahidol University, 2014).

From Institute for Population and Social Research, the number of the elderly in Thailand was increasing and the largest population of the geriatric was in the northern region–reported about 12.1% of total Thai population. As presented in **Table 1**, among all regions, the northern was predicted to be the second of rank of having high number of the geriatric population which will rise up to 16% and 23.9% in 2015 and 2025, respectively (The United Nations Fund for Population Activities, 2006). As it had been predicted, the proportion of the elderly in the northern region in 2014 was the largest which was approximately about 18.6% (Institute for Population and Social Research Mahidol University, 2014).

Table 1 The proportion of the older persons in each region of Thailand

Region	Percentage of older persons in total population		
	2005	2015	2025
Thailand	10.3	14.0	19.8
Bangkok metropolitan	8.6	11.9	18.6
Central (excluding Bangkok)	10.8	13.1	17.9
North	12.1	16.0	23.9
Northeast	9.6	14.7	21.4
South	10.4	13.2	17.8

Source: Institute for population and Social Research, Mahidol University, Population Projects for Thailand, 2005-2025, 2006.

Northern Thailand is composed of two sub-regions - Upper North and Lower North. This study is carried in the Lower North where Naresuan University is located. Lower Northern Thailand consists of eight provinces including Tak, Phitsanulok, Sukhothai, Phetchabun, Phichit, Kamphaengphet, Nakhonsawan and Uthai Thani. Thailand's National Survey reported that the elderly in the northern region were about 1,031,900 in 2014 (Institute for Population and Social Research Mahidol University, 2014).

Aging immunity

It has been reported that, at the biological level, aging is resulted from the impact of the accumulation of a wide variety of molecular and cellular damage over time. This leads to a gradual decrease in physical and mental capacity, a growing risk of disease, and ultimately, death (World Health Organization, 2015). One reason that helps explain this statement is that when people become older, their immune function gets impaired individually. This phenomenon is called 'immunosenescence'. Although the mechanism leading to immunosenescence is not clear, it has been

reported the association with increasing of the susceptibility of diseases, infections and poor response to treatments and vaccination (Pawelec, 2007).

When getting old, antigen-specific immunity is eroded partly due to alterations in the innate immunity. Changes from affected immune system lead to global dysfunctions. Although immunosenescence characterizes by changes in both the innate and adaptive arms of the immune system (Nikolich-Zugich, & Land, 2009), the important contributor to decline in immune function in the elderly is the changes observed in adaptive immunity, including T and B lymphocytes. From above, invaders will not be eliminated as fast as they should, so the geriatric's body will present as easier of having disease.

Moreover, the geriatric may have persistent inflammation over time favoring the susceptibility to age-related diseases. This happens because they have longtime exposure to continuous antigenic stress, so their immune system have up-regulation of cellular and molecular processes, resulting in increasing of serum levels of pro-inflammatory cytokines and other inflammatory markers: Interleukin (IL) -6, IL-8, IL-15 and IL-18; and also coagulation factors such as fibrinogen and Von Willebrand factor (Desai, & Yung, 2011).

Aging and architecture change of oral mucosa

Similarly to general health status, oral diseases such as dental caries, periodontal disease and oral mucosal disease are significantly found in elderly populations (Al-Maweri et al., 2015). The prevalence of oral mucosal lesions have been reported in the range of 50-90% in the elderly (Bakhshi et al., 2015).

In elderly patients, their oral mucosa become weak and can be easily injured. The plausible reasons for friability are the losing of intracellular fluid via both that shifting to the extracellular and dehydrating from kidney's function impairment; thinning of epithelium layer (Malik, Rathee, & Bhoria, 2015); and losing the collagen in connective tissue compartment (Hebling, 2012).

Oral epithelium is one of the innate immune system which play role as a physical barrier protecting the underlying tissues from both mechanical and chemical trauma (Desai, & Yung, 2011). There are many studies which variably report about the changes of epithelium in elderly patients such as changing in shape and size of

epithelial cell, decreasing of the prominence of rete ridges, mean thickness, cell density, mitotic activity and having slower rate in tissue regeneration and healing process. Due to the differences of methodology, how epithelial cell is really affected by aging both in terms of quantity and quality is still controversial. However, most of the studies reported that the aging change of epithelium characterizes as thinning of its layer. This change causes the allowance the pathogen and/ or irritant to harm the tissues underneath and result in oral soft tissue lesion (Abu Eid et al., 2012).

Not only epithelial component is affected by the increasing age, but does the connective tissue component as well. Previous studies review that the elder patients are, the lower the number of cellular elements in the connective tissue is. In addition, the collagen synthesis is reduced due to the increasing of methylation at DNA structure at collagen alpha I gene which caused lower mRNA levels and resulted in decreasing of collagen type I synthesis. It is considered that collagen synthesis in the elderly is reduced five times more than those younger. At the same time, collagen degradation is elevating. The imbalance of this collagen synthesis and degradation finally contributes to weakened connective tissues compartment (Hebling, 2012).

General health and oral health

Globally, it has been reported that general health has association with oral health and it is particularly pronounced among the elderly, primarily because it plays role as common risk factors (Petersen, & Yamamoto, 2005) – Oral candidiasis is associated with diabetes mellitus (Bartholomew, Rodu, & Bell, 1987); chronic liver disease can cause pigmentation change of the oral cavity (Urse, 2014); and malnutrition is associated with atrophic glossitis (Glick, 2015).

The ranking of top five systemic diseases are varying between countries. In Thailand, from Thai National Health Survey 2013, the top five are cerebrovascular disease, coronary disease, pulmonary obstruction, diabetes mellitus and liver cancer respectively (Thai Health Promotion Foundation, 2013). As described above, all these systemic conditions characterize as common risk factors of oral diseases. It is necessary to collect this medical data to help determine the cause of oral diseases. This will lead to proper diagnosis and treatment (Glick, 2015).

Medication usage

Due to having longtime exposing to multi-medication, old adults are at increased risk for drug-related complications which impacts both general health and oral health care (Petersen, & Yamamoto, 2005). From previous studies, there were many types of drug that related to some oral lesions, for example lichenoid drug reaction from anti-diabetes and anti-hypertensive drug use (Kaomongkolgit, 2010); median rhomboid glossitis can be found in those patients who use inhaled steroid (Glick, 2015); and oral candidiasis is associated with topical steroid usage, long-term antibiotic therapy and immunosuppressive drug (Neville et al., 2015).

Moreover, some medication can cause xerostomia which is a contributing factor of some oral mucosal lesions such as oral candidiasis. There are many medication-induced salivary gland dysfunctions that have already been reported. Mostly of them are responsible for dry mouth are tricyclic antidepressant, antipsychotics, atropinics, beta-adrenergic blockers and antihistamines (Ship et al., 2000; Thomson et al. 2000).

Also, some of medicines cause pigmented lesion which is called "drug-induce melanosis". Previous studies had been reported many types of medicines which their metabolites could deposit in oral soft tissue such as Amioarone, Chloroquine, Ketoconazole (Glick, 2015).

Gender and oral mucosal lesions

Previous studies showed that prevalence of some oral conditions was associated with specific gender. In Yemen, there was higher prevalence of oral mucosal lesion in males than females, as men do have higher risky habits than women (Al-Maweri et al., 2015). Leukoplakia and smoker's melanosis were associated with males (Petersen, & Yamamoto, 2005). Lichen planus was prominently found in females than males (Jainkittivong, Aneksuk, & Langlais, 2002).

Oral habits and oral mucosal lesions

There are various types of oral habits that the geriatric may have - smoking, alcoholic beverage consumption and areca nut chewing. In this study will focus on these three habits because they were suggested as risky behavior that could lead to

disability of the elderly in Thailand (Bereau of technical and knowledge management, 2015) and somehow they also cause them the risk of having oral diseases (Neville et al., 2015).

Smoking

Smoking is an important risk of cancer of lung, larynx, oral cavity, pharynx, esophagus, pancreas, bladder, kidney, cervix, and stomach, and acute myeloid leukemia. It can cause malignancy because each puff of each cigarette contains a mixture of thousands of compounds, including more than 60 well-established carcinogens. The carcinogens containing in cigarette smoke belong to multiple chemical classes, including polycyclic aromatic hydrocarbons (PAHs), N-nitrosamines, aromatic amines, aldehydes, volatile organic hydrocarbons, and metals (U.S. Department of Health and Human Services, 2011).

When exposing to carcinogens, carcinogens will form covalent bonds to DNA of cells. Somehow, it accumulates permanently and cause somatic mutations in critical genes resulting in clonal outgrowth and development of cancer (U.S. Department of Health and Human Services, 2011).

In the field of dentistry, smoking is a closely related cause of many oral mucosal lesions. There are many lesions have already been reported that are caused by irritating from smoking including actinic cheilitis; nicotinic stomatitis; smoker's malanosis; oral premalignant lesion such as oral leukoplakia and oral erythroplakia; and oral cancer such as squamous cell carcinoma (Glick, 2015). It is reported that the risk appear correlated to the number of cigarettes smoked each day (Neville et al., 2015).

Alcohol consumption

There are many studies determining the association between alcohol consumption and oral mucosal lesions. The results are various because of the different in criteria and research design, but it is believed that alcohol consumption is a risk factor for oral premalignant lesion including oral leukoplakia, oral submucous fibrosis and erythroplakia (Thomas et al., 2003).

Mechanisms of alcohol that cause irritation to oral mucosa are described in many ways. Firstly, alcohol increases the solubility and permeability of carcinogen, so that they can penetrate through the oral mucosa. Secondly, chronic consumption

causes oral mucosal dehydration, atrophy and hyper-regeneration, thereby making the epithelium more susceptible to chemical carcinogens.

Moreover alcohol potentiates the genotoxicity of carcinogenic agents that inhibit DNA repair capacity. Alcohol itself also causes systemic effects such as malnutrition and immunosuppression; and its metabolite like acetaldehyde do have mutagenic property (Maserejian et al., 2006).

Areca nut chewing

In Thailand, areca nut chewing is traditional oral habit usually found in the elderly. From 1979 to 1984, there is a study carried out among Northern Thai hill tribes; Lahu, Karen and Lisuand Meo; and rural Thai. Prevalence of the betel-quid chewing habit was reported to be 5-44% in men and 9-46% in women (Humans Organization, & Cancer, 2004).

When chewing, there are three component needed which are leaf of *Piper betle* L., areca nut and slaked lime. All of them are reported as components which can harm oral tissue. Leaf of *Piper betle* L. has phenol product that will cause astringent taste and itself is a carcinogen. Areca nut has alkaloid product such as arecoline and arecaidine which could stimulate proliferation and collagen synthesis in human cultured fibroblasts. Also, it has cytotoxic properties. Slaked lime is the component that gives free radical including calcium hydroxide, ferric (II) ion and magnesium ion. The concentration of free radical in once normal areca nut is chewed does not directly harm oral tissue, but it enhanced other component to irritate oral tissue by producing alkaline condition (Humans Organization, & Cancer, 2004).

There are various of studies reported that areca nut chewing is a risk factor of causing oral lesion including oral leukplakia, oral submucous fibrosis and oral sqaumous cell carcinoma (Neville et al., 2015).

Denture wearing and oral mucosal lesions

When confronting with aging, one thing that usually happens is tooth loss both from dental caries and periodontal diseases. After teeth are lost, they will be replaced by denture. Denture wearing is usually found in elderly patients (Petersen, & Yamamoto, 2005). Previous study shows that wearing denture could develop more oral mucosal lesions, comparing with those patients who do not wear it. There are

variety of denture factors that had been reported the relation including types of denture, denture retention and stability (Turker et al., 2010; Martori et al., 2014; Mubarak et al., 2015), denture age (Moskona, & Kaplan, 1992; Jagger, & Harrison, 1995).

From previous study, it was reported that removable dentures cause higher prevalence of denture-related oral mucosal lesion, comparing with fixed dental prosthesis and the most common lesion found, is denture-related stomatitis. Also, it was reported that those removable denture which has poor fitting dentures can cause irritation to mucosal tissue and cause some oral lesion including frictional keratosis traumatic ulcer and denture-induced fibrous inflammatory hyperplasia (Glick, 2015; Neville et al., 2015).

Although there are fewer cases of oral mucosal lesions caused by fixed denture including crown and bridge, it does have. Most of the cases are allergic contact stomatitis (Emami et al., 2014).

Moreover, not only wearing denture will increase the risk of having oral diseases, the denture wearing habits such as nocturnal wearing (Compagnoni et al., 2007; Emami et al., 2014); and denture hygiene are also matter (Naik, & Pai, 2011). It was reported that the patients who wear denture overnight will increase a risk of having *candida* associated denture induce stomatitis. The same as night wearing, the patients with poor denture hygiene have tendency to have *candida*-associated denture-induced stomatitis as well (Marinoski, Bokor-Bratić, & Čanković, 2014).

In Thailand, 45% of patients who wear denture develop denture-related mucosal lesions and 60% develop oral mucosal lesions which do not related to the denture (Jainkittivong, Aneksuk, & Langlais, 2002).

Prevalence of common oral mucosal lesions in the elderly

In the past, the study on elderly patients was not well available, but since the advanced medical technology which provides the extension of average human lifespan, the number of geriatric studies seems to increase (Petersen, & Yamamoto, 2005). Similarly, in the field of dentistry, the research on geriatric is booming. As we have known that the aging patients have more tendencies to have oral diseases such as dental caries, periodontal diseases, degenerative diseases, and also oral mucosal

lesions. Afterwards, studies focusing on the prevalence of oral diseases are elevating, studies on oral mucosal lesions also do. The prevalence of oral mucosal lesions were reported, vary in result between countries. The example of them will be described below.

In Thailand, there is a clinical-based study mentioning the prevalence of oral mucosal lesions, conducted by Jainkittivong, Aneksuk, & Langlais in 2002. The participant of this study was the patient who had attended the Faculty of Dentistry, Chulalongkorn University, Thailand. The result suggested that age, gender and denture wearing are factors related to the presenting of oral mucosal lesions. Some of the oral mucosal lesions suggested in this study will be described below (Jainkittivong, Aneksuk, & Langlais, 2002).

Common oral mucosal lesions in the elderly

Foliate papillitis

Foliate papillitis is a tongue disorder. This term is used to call the inflammatory of foliate papilla which is mostly located at lateral border of tongue. Foliate papillitis is present as numerous projections arranged in several transverse folds on the lateral margins of the tongue, just anterior to the palatoglossal fold (Ghom, & Ghom, 2014). The prevalence reported among the geriatric patients was about 0.2% (Jainkittivong, Aneksuk, & Langlais, 2002). The diagnosis mainly base on clinical appearance (Ghom, & Ghom, 2014).

Hairy tongue

Hairy tongue is the lesion usually found in those patients who are heavy smokers, have poor oral hygiene or have been treated with radiotherapy at head and neck region. The lesion appears as yellow to black-color hairy projection from higher accumulation of keratin at filiform papillae of tongue. The prevalence reported among the geriatric patients was in the range of 2.3-16.5% (Jainkittivong, Aneksuk, & Langlais, 2002; Al-Maweri et al., 2015; Bakhshi et al., 2015).

Atrophic glossitis

Atrophic glossitis is the term for tongue lesions that appear as diffuse papillary atrophy of dorsum of tongue. This lesion is associated with nutrition such as iron and vitamin B deficiency (Neville et al., 2015). The prevalence reported among

the geriatric patients was in the range of 2.9-37.1% (Jainkittivong, Aneksuk, & Langlais, 2002; Cueto et al., 2013; Al-Maweri et al., 2015; Bakhshi et al., 2015). If the lesion is suggest to be atrophic glossitis, complete blood count and nutritional status should be further investigate.

Oral candidiasis

Candidiasis is the most common fungal infection found in oral cavity. The prevalence reported among the geriatric patients was in the range of 1.8-51% (Jainkittivong, Aneksuk, & Langlais, 2002; Paillaud et al., 2007; Mujica, Rivera, & Carrero, 2008; Cueto et al., 2013; Patil, Doni, & Maheshwari, 2015; Santos et al., 2015). Mostly it is caused by species *Candida albicans.* Oral candidiasis tends to increase through the advancing age, especially in those patients with uncontrolled diabetes mellitus, long-term antibiotic use, malnutrition (Paillaud et al., 2007) and AIDs patient, etc. In this part will compose only three types of oral candidiasis including pseudomembranous type, erythematous type and hyperplastic type.

Pseudomembranous type appears as white to yellowish membrane covering the mucosal surface. The membrane can be rubbed off, leaving the raw surface underneath. To confirm the diagnosis microscopic examination should be taken which will present the budding yeast and also fungal hyphae after stained with potassium hydroxide *or* Periodic acid–Schiff (Glick, 2015). Erythematous type is the lesions which present as red area of oral mucosal tissues. To confirm the diagnosis, the clinician may have to investigate more such as imprinting and culturing for *Candida* species; biopsy; and titration of *Candida* species from saliva. Lastly, hyperplastic type presents as white plaque which cannot be rubbed off, usually located at retrocommissural area. For this type, the lesion should be biopsy and check for dysplasia of the epithelium because this type has high potency of malignant transformation (Glick, 2015).

Angular cheilitis

Angular cheilitis is an inflammatory lesion at lip commissure which is characterized as fissure or even ulceration. This lesion is usually found in the elderly with no specific gender. The prevalence reported among the geriatric patient was in the range of 2.6-18% (Jainkittivong, Aneksuk, & Langlais, 2002; Espinoza et al., 2003; Mujica, Rivera, & Carrero, 2008; Cueto et al., 2013; Al-Maweri et al., 2015;

Bakhshi et al., 2015; Patil, Doni, & Maheshwari, 2015; Santos et al., 2015). It has many predisposing factors involved which can be divided in to three categories - infection, occlusal vertical dimension loss and nutritional deficiency. The most causative infective species is *C. albicans*, followed by *Streptococcus aureus*. Occlusal vertical dimension loss is related to improper design of denture. For nutritional deficiency, relative nutrients are iron, vitamin, zinc and folate which sometime we can find this consideration in those patients who are deficiency anemia, Crohn's disease, immunocompromised, and/or malabsorption disorder (Glick, 2015; Neville et al., 2015).

Median rhomboid glossitis

World Health Organization has described median rhomboid glossitis as a benign condition, clinically characterized by a red, usually smooth, sometimes elevated rhomboid shaped lesion on the central part of the dorsum of the tongue, just anterior to the circumvallate papillae. At the same time, it can cause other lesions at the palate called "kissing lesion". Median Rhomboid glossitis is often asymptomatic, but may cause soreness while taking spicy food. This is more common among males. This lesion is caused by *Candida* infection. The diagnosis is mainly based on clinical examination. However, if there is any suspicion, a biopsy may be recommended. The prevalence reported among the geriatric patients was about 1.3 % (Al-Maweri et al., 2015).

***Candida* associated denture induced stomatitis**

This lesion is a common infectious disease caused by *Candida* in the patients who wear denture. The prevalence of these lesions was about 50% (Glick, 2015). The prevalence reported among the geriatric patients was in the range of 2.9-37.1% (Jainkittivong, Aneksuk, & Langlais, 2002; Espinoza et al., 2003; Mujica, Rivera, & Carrero, 2008; Cueto et al., 2013; Al-Maweri et al., 2015; Patil, Doni, & Maheshwari, 2015; Santos et al., 2015).

It often locates on upper arch rather than the lower one and is usually found in those who wear the denture overnight and those who have systemic compromise such as having diabetes mellitus and hyposalivation. The clinical presentation has three forms which are divided into three grades. Grade I is for the lesion which appears as pinpoint hyperemia at the tissues under the denture. Grade II is for the erythematous

lesion which fully extends under the denture. Grade III is for the lesion which appears as erythematous area with granular projection of tissues under the denture. If the diagnosis is uncertain, the investigation including imprint culture, impression culture or salivary culture is practical tool for getting diagnosis (Glick, 2015).

Denture-induced fibrous inflammatory hyperplasia

Denture-induced fibrous inflammatory hyperplasia or epulis fissuratum is the term to call overgrowth of tissues from improper denture, often seen as two or three folds of tissues under flank of denture (Neville et al., 2015). This lesion is usually found in the middle-aged and older adults, as would be expected with a denture-related lesion (Anura, 2014; Neville et al., 2015). In addition, it seems to be more pronounced in females than males. The prevalence reported among the geriatric patients was in the range of 2–2.1% (Jainkittivong, Aneksuk, & Langlais, 2002; Mujica, Rivera, & Carrero, 2008; Cueto et al., 2013). Main diagnosis can be made from clinical appearance and denture-lesion relationship (Neville et al., 2015).

Epithelium desquamation

Epithelium desquamation is called those shredded epithelium caused by mild irritation, especially chemical one – dentifrice or mouthwash. It characterizes as white thin film which can be easily slough off. Most of the case was asymptomatic and accidentally found (Glick, 2015).

Frictional keratosis

Frictional keratosis typically present as white lesion without any red area. It is a physiologic response of oral mucosa to the frictional force such as food intake, denture wearing or other minor trauma. The prevalence that has been reported is ranking from 2-7% and it predisposing factors are smoking and alcoholic beverage consumption (Glick, 2015). The prevalence reported among the geriatric patients was in the range of 1.6-23% (Jainkittivong, Aneksuk, & Langlais, 2002; Espinoza et al., 2003; Al-Maweri et al., 2015; Bakhshi et, al., 2015; Patil, Doni, & Maheshwari, 2015). To diagnose the lesion as frictional keratosis, the clinician must found out the chronic mechanical trauma to area where the lesion is, then eliminate the causative trauma. If the lesion disappears within few days to weeks, this diagnosis is validated (Scully, 2013).

Morsicatio

Morsicatio is the term used to call lesion caused by chronic tissue biting. It is usually found at buccal and labial mucosa. However, it can also be found at tongue. To be specified, it is put the suffix to represent the location including morsicatio buccarum, morsicatio labiorum and morsicatio linguarum for chronic biting of buccal mucosa, labial mucosa and tongue, respectively.

Morsicatio has the specific appearance and can usually be diagnosed from clinical feature and history of chewing habit. It characterizes as white asymptomatic shredded area, but does not entail ulceration. Among the geriatric, It is reported the prevalence about 0.8-1% (Al-Maweri et al., 2015; Bakhshi et al., 2015).

Mucosal burn

Mucosal burn is the term used to call necrosis of the epithelium from stimuli–thermal and chemical. The most common chemical agent usually found the relation with this lesion is aspirin– patients put into large cavitated caries or nearby mucosa to get rid of toothache.

Traumatic ulcer

It is the term calling the ulceration that cause by mechanical, chemical and also thermal trauma. It is presented as erythematous area covered with removable yellow fibrinopurulent membrane. The margin of the lesion is usually irregular in shape and red in color (Neville et al., 2015). The prevalence which was reported among the geriatric patient was in the range of 0.7-21.44% (Jainkittivong, Aneksuk, & Langlais, 2002; Espinoza et al., 2003; Mujica, Rivera, & Carrero, 2008; Cueto et al., 2013; Al-Maweri et al., 2015; Bakhshi et al., 2015; Patil, Doni, & Maheshwari, 2015; Santos et al., 2015). To distinguish this lesion from the other ulcerative lesions, clinical appearance should be examined carefully, together with found out the causative trauma (Scully, 2013; Glick, 2015).

Aphthous ulcer

Aphthous ulcer or recurrent aphthous stomatitis is common lesion in oral cavity. The prevalence reported among the geriatric patients was in the range of 0.3–3.1% (Jainkittivong, Aneksuk, & Langlais, 2002; Espinoza et al., 2003; Mujica, Rivera, & Carrero, 2008; Cueto et al., 2013; Al-Maweri et al., 2015; Bakhshi et al., 2015). Aphthous ulcer usually appears as round or ovoid shape with circumscribed

margin and erythematous halo. The lesion can affect both non-keratinized and keratinized epithelium, but mainly on non-keratinized one (Chavan et al., 2012; Glick, 2015). Mostly aphthous ulcers can be diagnosed from history and clinical appearance, but for those lesions that resembling the other ulcerative lesions, it should be excluded from infectious cause, deficiency status and also gluten intolerance (World Health Organization, 1980).

Mucous membrane pemphigoid (MMP)

Mucous membrane pemphigoid is a chronic autoimmune disease usually found in patients whose age is above 50 (Glick, 2015). This lesion causes a subepithelial vesicle involving both oral mucosa and conjunctiva. Mucous membrane pemphigoid usually affects patients whose age is above 50 and is twice as common in females rather than males. The prevalence reported among the geriatric patients was about 0.19-0.8 % (de Vasconcelos Carvalho et al., 2011; Bakhshi et al., 2015; Qannam, & Bello, 2016). Typically, the patients will have desquamative gingivitis with blood blister. This lesion may give Nikolsky's sign both positive and negative. To confirm the diagnosis, the clinician should do the biopsy and test with direct immunofluorescent staining which will glow at the basement membrane (Taylor et al., 2015).

Pemphigus vulgaris (PV)

Pemphigus vulgaris, the most common form of pemphigus, is a life-threatening autoimmune disorder. It is caused by autoimmune to desmoglein-3 and characterized as intraepithelial vesicle. Pemphigus may occur at all ages, but most people are middle-aged at the time of presentation. The incidence of it was less than one per 100,000 per year (Jacobson et al., 1997) and previous prevalence was around 0.9% (Qannam, & Bello, 2016). The clinical appearance is flaccid bullae at mucosal site which can be easily ruptured and become the ulceration. This lesion will give Nikolsky's sign positive and to confirm the diagnosis, the clinician should do the biopsy and test with direct immunofluorescent staining which will glow with fishnet pattern (McMillan et al., 2015).

Radiation therapy-induced oral mucositis

Since the some types of cancer cannot be treated with surgery alone, radiation therapy becomes necessary. For treating head and neck cancer, the most common

complication of oral mucosa from radiation therapy is oral mucositis. The lesion will start after the therapy about 7 days and 33% of patients will have oral sensitivity due to mucosal atrophy and 16% will have neurologic syndrome. The prevalence reported among the geriatric patients was about 0.2 % (Jainkittivong, Aneksuk, & Langlais, 2002). To be given diagnosis as radiation therapy-induced oral mucositis, the clinician should ask the patients for their history of irradiation (Scully, 2013).

Chemotherapy-induced oral mucositis

Chemotherapy is widely used to treat cancer. One of the oral complications after chemotherapy treated is oral mucositis. It presentation is as same as those mucositits caused by radiation. Thus, the main diagnosis come from history of taking chemotherapy drug (Naidu et al., 2004). To be given diagnosis as radiation therapy-induced oral mucositis, the clinician should ask the patients for their history of using chemotherapy agent (Scully, 2013).

Vascular malformation

Vascular malformation is a developmental vascular anomaly. The lesion appears as bluish color of the tissue. Elevating surface may be found in some case. When the lesion is hard to distinguish this lesion from other pigmented lesion, Diascopy test is technique of choice – it will becomes pale after apply pressure. Another clue foe diagnosis, it usually appears since birth and will never involute. Moreover, when palpate it usually presents the bruising of the underlining vessels. However this characteristic depends on type of vessel component in the lesion: arterial, venous or capillary. The prevalence of it was about 20.1% (Corrêa et al., 2007).

Blood extravasation

This term is used to call those dark lesions caused by trauma and subsequently have a red blood cells leakage. The specific term of it depend on size of the lesion: pin-pointed – petechiae; less than 5 millimeters–purpura; and larger than 5 millimeters –hematoma. Among the geriatric studies, its prevalence is around 1.6-2.3% (Jainkittivong, Aneksuk, & Langlais, 2002; Bakhshi et al., 2015)

Melanotic macule

Melanotic macule is the most prevalent of melanocytic origin (Glick, 2015). This lesion caused by the increasing of melanin synthesis, not a number of

melanocyte. It appears as solitary, demarcated, uniform dark macule and often sized around one centimeter or lower. Melanotic macule is slightly preponderance among female rather than male and usually occur at labial mucosa and gingiva. Previous studies report its prevalence about 0.8-10.0% (Jainkittivong, Aneksuk, & Langlais, 2002; Mujica, Rivera, & Carrero, 2008; de Vasconcelos Carvalho et al., 2011; Al-Maweri et al., 2015; Bakhshi et al., 2015; Patil, Doni, & Maheshwari, 2015). To be given the diagnosis, biopsy and microscopic examination should be done. However in practical way, most cases refuse to do, so the diagnosis would be followed the clinical appearance and no treatment is given excepted after long term observation it gets rapidly evolve.

Melanocytic nevus

Unlike melanotic macule, melanotic nevus is caused by elevating number of melanocyte. Oral nevus is different from cutaneous nevi in many ways. First, it usually appears in female. Second, it is rare to find. However it does not have specific characteristic. It typically presented as single well defined lesion with brown or bluish color. As same as melanotic macule, its size is usually less than one centimeter, but the difference is, it could have elevating surface–papule or nodule. Also, in practical way, this lesion is usually diagnosed by clinical appearance. The prevalence of it was about 0.19-3.0% (Mujica, Rivera, & Carrero, 2008; de Vasconcelos Carvalho et al., 2011; Patil, Doni, & Maheshwari, 2015).

Drug-induced melanosis

This term is called those hyperpigmented lesions after previously used of medication. The darker color of the soft tissue is the result from deposition of drug's metabolite, lipofuscin and iron. It can appear either localized form or multifocal form. It is almost always flat. To be given the diagnosis, it must have history of drug intake (Glick, 2015).

Amalgam tattoo

Amalgam tattoo is used to call the tissue colored by metal component in amalgam. The prevalence reported among the geriatric patients was in the range of 0.7-11 % (Jainkittivong, Aneksuk, & Langlais, 2002; Mujica, Rivera, & Carrero, 2008; de Vasconcelos Carvalho et al., 2011; Patil, Doni, & Maheshwari, 2015). In clinic, this lesion will locate near the restoration. It character as well defined black

macule or, rarely, as slightly raised lesion. Sometimes radiographic examination may be used. The suspected site may have radiopaque area of metal component (Neville et al., 2015). To confirm the diagnosis of this lesion, the lesion should be biopsy and do the microscopic examination to exclude it from the other pigmented lesion including nevi and oral malignant melanoma (Scully, 2013). In contrary, biopsy may not be used to diagnose this lesion practically in clinic, so most of diagnosis made from the history of having amalgam restoration at the adjacent tooth, clinical appearance and sometimes radiographic appearance.

Post-inflammatory hyperpigmentation

This lesion is also classified as pigmented lesion. This term is used for dose pigmented lesion is found after previous injury or inflammation (Glick, 2105). In most of the case, post- inflammatory hyperpigmentation present as focal or localized fashion. In some lesion such as oral lichen planus, it may present as darker tissue beside the Wickham's striae–old lesion.

Smoker's melanosis

In a heavy smoker, the smoker's melanosis is usually found. The prevalence which was reported among the geriatric patient was in the range of 4-6.1% (Jainkittivong, Aneksuk, & Langlais, 2002; Al-Maweri et al., 2015). It characterized as hyperpigmentation area and can locate in any site of oral cavity, depending on what type of tobacco the patient used, but mostly it appears at anterior facial gingiva. The area of pigmentation significantly increases during the first year of smoking and the number of cigarettes smoked each day does matter. The diagnosis mainly comes from smoking history, clinical finding and also medical history (Neville et al., 2015).

Nicotinic stomatitis

Nicotinic stomatitis or smoker's palate is the lesion caused by thermal irritation at the palate. It is dominantly found in males. The prevalence reported among the geriatric patients was in the range of 0.2-43% (Jainkittivong, Aneksuk, & Langlais, 2002; Espinoza et al., 2003; Mujica, Rivera, & Carrero, 2008; Al-Maweri et al., 2015; Bakhshi et al., 2015; Patil, Doni, & Maheshwari, 2015). Typically, the lesion appears as white patch on the palate and cannot be rubbed off. Also there is the red dot inside which is representing the inflammation at minor salivary glands orifice (Neville et al., 2015).

Mucocele

Mucocele is a common lesion of oral mucosa which has two different types of causes which are the rupturing of salivary gland duct and the blockage of salivary duct. The two causes may present differently in histopathologic examination, but in clinic, it presents as the same. Mucoceles typically appear as flaccid dome-shape vesicles, commonly found on lower labial mucosa. The less common sites are floor of mouth, anterior ventral of tongue, buccal mucosa, palate and retromolar pad, respectively. The prevalence reported among the geriatric patients was in the range of 0.2–4% (Jainkittivong, Aneksuk, & Langlais, 2002; Espinoza et al., 2003; de Vasconcelos Carvalho et al., 2011; Bakhshi et al., 2015; Patil, Doni, & Maheshwari, 2015; Santos et al., 2015; Qannam, & Bello, 2016; Saravani et al., 2016). Mostly this lesion can be diagnosed from clinical appearance, but to confirm, microscopic examination should be done after remove those involving salivary gland (Neville et al., 2015).

Cyst

Many of cysts of the jaw arise both intraosseous calcifying odontogenic cyst, odontogenic keratocyst; and arise in tissue such as dermoid cyst, epidermoid cyst, etc (Neville et al., 2015). Some of them may present in swelling of oral mucosa, so this study will included all cystic lesions which have can be found when do the clinically exam.

Oral lichen planus (OLP)

Oral lichen planus is an inflammatory autoimmune disease which involved both at mucous membrane and cutaneous area. It is a worldwide disease, slightly to be predominant in female, but vary in age: from 30-65 years (Scully, 2013). The prevalence reported among the geriatric patients was in the range of 0.7-18% (Jainkittivong, Aneksuk, & Langlais, 2002; Cueto et al., 2013; Al-Maweri et al., 2015; Bakhshi et al., 2015; Patil, Doni, & Maheshwari, 2015; Santos et al., 2015; Saravani et al., 2016). At mucous area, it can be characterized in five different ways – papular, reticular, plaque, atrophic and ulcerative. If the lesion is suggested to be oral lichen planus, but the diagnosis is uncertain, biopsies together with microscopic examination should always be taken (Glick, 2015).

Lichenoid reaction

Lichenoid reactions are reactive lesions which have clinical presentation alike to lichen planus. It is believed that these lesions caused by autoimmuity. From the 4th *World Workshop of Oral Medicine,* lichenoid reactions are divided into three groups depending on causes including lichenoid contact reaction, lichenoid drug reaction and lichenoid reaction of graft versus host disease. However, these lesions cannot be distinguished from lichen planus clinically and histopathologically since they appear the same. The diagnosis was depending on history of exposing to allergens (Al-Hashimi et al., 2007). The prevalence reported among the geriatric patients was in the range of 0.48-2.1 % (Espinoza et al., 2003; Qannam, & Bello, 2016; Saravani et al., 2016).

Areca nut stain

In those chronic areca nut chewers, areca and additives component can attach to mucosa. It appear as sticky red to brownish color film which is not easy to remove. The diagnosis mostly made from clinical appearance and the history of areca nut chewing. In the study of the geriatric, its prevalence is around 1.2% (Jainkittivong, Aneksuk, & Langlais, 2002).

Leukoplakia

World Health Organization defines leukoplakia as clinical patches that cannot wipe off the mucosa and cannot be classified clinically as another specific disease entity. This lesion can be found in all genders with no specific geographic incidence (Scully, 2013). It usually attacks people whose age is 40 or above, the average is 60 years (Neville et al., 2015). The prevalence is approximately 2.6% in the world (Prasad et al., 2015). The prevalence reported among the geriatric patients was in the range of 0.3 - 22 % (Jainkittivong, Aneksuk, & Langlais, 2002; Espinoza et al., 2003; Mujica, Rivera, & Carrero, 2008; Al-Maweri et al., 2015; Bakhshi et al., 2015; Patil, Doni, & Maheshwari, 2015; Santos et al., 2015; Saravani et al., 2016). Clinically, leukoplakia has a wide range of presentations and locations. More than 90% of lesion presenting on tongue, lip vermillion and floor of mouth shows dysplasia and carcinoma, so it is thought to be a premalignant lesion (Jainkittivong, Aneksuk, & Langlais, 2002; Cueto et al., 2013).

Erythroleukoplakia

Erythroleukoplakia is the other term to call non homogeneous leukoplakia. The same as leukoplakia, this term is used for white patch or plaque with some of part of erythematous area that cannot be categorized clinically or pathologically like any other diseases. The difference between leukoplakia and erythroleukoplakia is that the latter has component of red area. This lesion can be located at any site of oral cavity and it has potential to cause malignant transformation more than leukoplakia (Glick, 2015).

Erythroplakia

World Health Organization defines erythroplakia as any lesion of the oral mucosa that presents as bright red velvety plaques which cannot be characterized clinically or pathologically as any other recognizable conditions (Scully, 2013). It is predominantly found in males rather than females and usually in middle-aged or elderly patients (Reichart, & Philipsen, 2005).

Fibroma

Fibroma is the most common reactive soft tissue enlargement in oral cavity. The prevalence reported among the geriatric patients was about 3.4-19.0 % (Espinoza et al., 2003; Mujica, Rivera, & Carrero, 2008; de Vasconcelos Carvalho et al., 2011; Patil, Doni, & Maheshwari, 2015; Santos et al., 2015; Qannam, & Bello, 2016; Saravani et al., 2016). It is caused by chronic irritation or trauma and it can be found any part of oral cavity, but mostly located at buccal mucosa. Its typical appearance is sessile smooth surface nodule with pale pink color, but in some cases it may present with hyperkeratosis or hyperpigmentation (Neville et al., 2015). To confirm the diagnosis, biopsy and do microscopic examination should be done (Scully, 2013).

Pyogenic granuloma

Pyogenic granuloma is the lesion that characterize as single pedunculated nodule with various color from pale pink to bluish red, depending on lesion's age. It is predilection among female and usually occur near gingival margin. Pyogenic granuloma caused by chronic irritation. However systemic disturbance such as changing of hormone during pregnancy could initiate the lesion also. Its prevalence is around 1.0-22.0% (Espinoza et al., 2003; Mujica, Rivera, & Carrero, 2008; Torres-Domingo et al., 2008; de Vasconcelos Carvalho et al., 2011; Patil, Doni,

& Maheshwari, 2015; Santos et al., 2015; Qannam, & Bello, 2016; Saravani et al., 2016). The definitive diagnosis would be given only after biopsy and do the microscopic examination.

Benign tumor

There are many types of benign tumor found in oral cavity, but mostly are odontogenic tumors such as ameloblastoma, myxoma, ameloblastic fibroma, etc. The prevalence of benign tumor depends on many factors including gender, age, race and even risk behavior that patient has. There are many studies reported 7-17.1% of the prevalence of benign tumor among the geriatric patients (Al-Maweri et al., 2015; Patil, Doni, & Maheshwari, 2015).

Malignant tumor

As same as benign tumor, malignant tumor is not common to find. The most common malignant tumor in oral cavity is squamous cell carcinoma which is about 90% of all cases, but other malignant tumor can be found either, such as other epithelial malignancy, salivary gland malignancy and also metastasis tumor (Neville et al., 2015). The prevalence reported among the geriatric patients was in the range of 0.2-42.5 % (Jainkittivong, Aneksuk, & Langlais, 2002; Espinoza et al., 2003; Mujica, Rivera, & Carrero, 2008; Bakhshi et al., 2015; Patil, Doni, & Maheshwari, 2015; Santos et al., 2015; Qannam, & Bello, 2016; Saravani et al., 2016).

As described above, the participants in that study of Jainkittivong, Aneksuk, & Langlais were patients who attended the Faculty of Dentistry, Chulalongkorn University, mostly came from Bangkok. Their way of living, exposure to environment and also socioeconomic status are quite different from those who lived in the Lower Northern Thailand, so the prevalence of their studies may not adapt well with people out here. Another mention is that the study was conducted since 2002.

From the above statement, there is only a few of currently available information reported about the prevalence of oral mucosal lesions and the association of them with medical conditions on geriatric patients in Lower Northern Thailand, so the aim of this study is to evaluate the prevalence of oral mucosal lesions in the geriatric who attend the Dental Hospital, Naresuan University, Thailand, and to determine the association between them and age, gender, medical conditions, oral habits and denture wearing.

CHAPTER III

RESEARCH METHODOLOGY

Population and samples

This study will include all patients whose age is equal or above 60 years old and attend the Dental Hospital, Naresuan University. Then, those who have memory and recognition problems including delirium, Alzheimer and those who are semiconscious will be excluded from the study. To exclude this group of patient, they will be test with mini–mental state examination (MMSE). Also, those patients who do have denture, but do not bring it in that visiting day will be excluded too. The sample size determination will be done by using Cochran's equation as presented below (Naing, Winn, & Rusli, 2006).

Cochran's equation:

$$n=\frac{p(1-p)Z^2}{e^2}$$

n = Sample size

p = Expected proportion

Z = Z statistic for a level of confidence

e = Minimum acceptable difference

This study's sample size:

$$n=\frac{0.836(1-0.836)(1.96)^2}{(0.05)^2}$$

$$=210.68$$

$$\approx 211$$

Research instrument

1. Data collecting sheets
2. Dental unit
3. Examination set
4. Other investigation materials depending on what lesion is needed.

Data Collection

The patients will be interviewed about their birth date to calculate their age at the time they visit the Naresuan University dental hospital, Thailand. Then, their age will be subcategorized into five subgroups which are 1) patients whose age is between 60-64 years, 2) patients whose age is between 65-69 years, and 3) patients whose age is 70 years or above.

Also, they will be interviewed about their gender, living location, and medical conditions including their systemic diseases, history of cancer treatment, head and neck radiotherapy, medication use and also allergy. If there are other conditions out of what are informed in the questionnaire, all that conditions will be added into the group of other and the details will be recorded at the same time.

Oral habits

For oral habits, patient will be grouped in three parts which are history of smoking, areca nut chewing and alcoholic beverage drinking. The behavior will be counted as having when patients behave the same habit it three times per week and continue behaving for at least six months. In this study, the habit that the patient has behaved at least three times has chosen in order to ensure that these behaviors are not occasional behaviors. Also, the study chooses six months as a boundary as it has been reported that the behavior which has repeated at least six months continuously, it will become permanent (Welk, 2002).

The term of smoking in this study is defined as sucking the smoke from a tobacco product such as cigarette, cigar, pipe, etc., into oral cavity and lungs, then exhaling it. All patients will be interviewed about the smoking history and categorized into two groups which are those who 1) have never smoked or have already quit smoking and 2) are still smoking.

Definition of alcohol drinking in this study is to drink any beverages containing alcohol. Patients will be divided into two groups which are those who 1) have never drunk or have already quit drinking and 2) are still drinking

In this study areca nut chewing will defined as chewing part of areca nut, whether together with betel leaf and slaked lime or not. Since there is no protocol to measure the areca nut chewing habit, this study will follow the method of evaluation smoking and alcohol drinking, so that it would be measurable. As same as smoking and alcohol drinking history, the patients will be categorized into two groups which are those who 1) have never chewed or have already quit chewing areca nut and 2) are still chewing areca nut.

Denture wearing

In the part of denture wearing, patients will be interviewed whether they wear denture or not. If they do, they will be asked whether upper or lower dentures they wear. The details of each arch will be added, including types of denture that they have – complete denture; removable partial denture; temporary plate; valplast; and fixed prosthesis: crown and bridge. Types of denture will be determined only after the examiner have inspected, if not, the data of this patient will be excluded from the study. Removable bridge will be counted as temporary plate due to its property which can be removed during the night.

For denture hygiene, in this study will modified from Naik and Pai's protocol and divided into denture hygiene into three groups including; good - without any plaque and calculus in both tissue surface and polish surface; fair–less than $1/3^{rd}$ of plaque and calculus in both tissue surface and and polish surface; and poor–over $1/3^{rd}$ denture covered with plaque and calculus (Naik, & Pai, 2011).

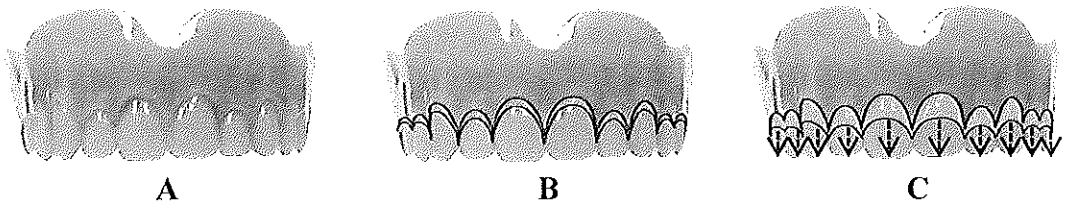

Figure 2 Denture hygiene classification: A–good; B–fair; and C–Poor

For denture fitting, this study will modify criteria from following Mccord and Grant's protocol. For upper denture retention, the denture would be forced the denture downward; good retention–cannot be remove easily; and poor stability–can be remove easily. For lower denture retention, denture will be checked by pressuring at one site of denture; good retention–no tilting of the other site; and poor retention–tilting of the other site.

Also their denture will be checked for denture stability. The denture would be forced horizontally; good–have no movement; and poor–have movement. Only those dentures which have both good stability and retention will be collected as good-fitting. The other conditions will be collected as ill-fitting (McCord, & Grant, 2000).

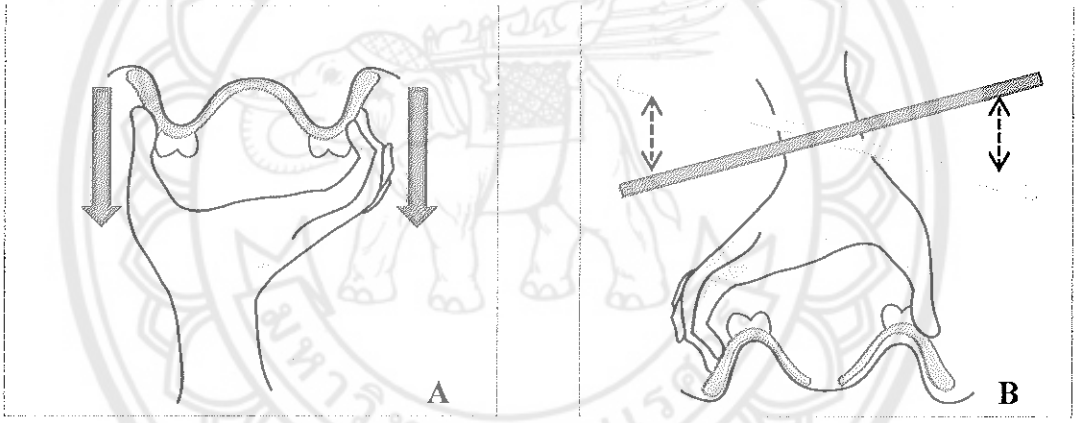

Figure 3 Denture retention testing: A–for upper denture by forcing it to the occlusal site; and B– for lower denture by pressuring at one site of denture and observing the tilting movement

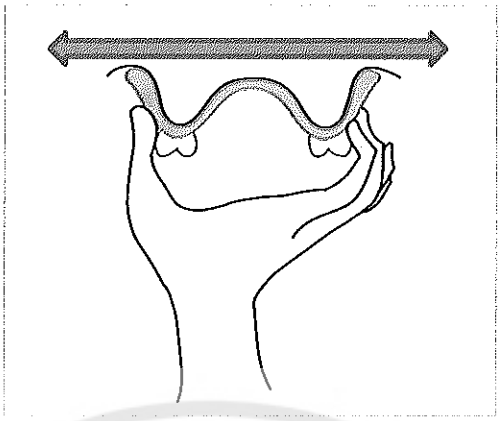

Figure 4 Denture stability testing by forcing the denture horizontally

Finally, those who wear the removable one will be asked whether they put it off overnight. This study will not determine the association between denture hygiene and the present of oral mucosal lesions because some patients will not show their denture to the dentist and some of them will over clean their denture just before they visit dental hospital. From these reasons, this information will have a high risk of inaccuracy.

Intraoral examination

Intraoral examination will be done only on the dental unit which has adequate light. Moreover, each case of examination will have an examination set which includes mouth mirror, explore no.5 and cotton pliers. Each of the lesion will be recorded the diagnosis together with location into data sheet. To be diagnosis, after examine the lesion, the examiner will set up the differential diagnosis which is modified from Scully's diagnostic guideline (Scully, 2013) and Glick's diagnostic guideline (Glick, 2015), see in appendix. Then each lesion will be confirmed the diagnosis clinically following World Health Organization Guideline as being described in the review of literature.

The lesions which are suspected to be premalignant lesion; longtime or unresponsive ulceration, leukoplakia, erythroplakia, erythroleukoplakia and submucous fibrosis; cyst; benign tumor; and malignant tumor will be confirmed by histopathologic examination from Board certified pathologist. Also, those lesions

which have epithelial cellular atypia but cannot be defined as benign or malignant tumor will be signed as epithelial dysplasia. Other investigations will be also carried out individually, following World Health Organization Guideline.

This study will collect only soft tissue lesions and the diagnosis of each of them will follow World Health Organization; Guide to epidemiology and diagnosis of oral mucosal diseases and conditions 2006. Each lesion of each patient will be counted only once. Only objective symptoms will be counted. Subjective symptoms, including those lesions that present as normal appearance but having alteration in sensation such as trigeminal neuralgia and burning mouth syndrome will be excluded from this study.

In the data sheet will compose of some of oral mucosal lesions which mention to be commonly found or have already been studied about the prevalence among the geriatric clinically. For those lesions which are extra from that have been informed in the data sheet will be categorized as "others" and the diagnosis and location will be recorded at the same time.

Examiner

This study will have only one clinical examiner which is Dr. Adjabhak Wongviriya, D.D.S.

Analysis of Data

All data collected in the data sheet will be grouped and then transferred to the manipulating software SPSS version 17.0. Data were summarized using descriptive statistics and present as frequency of distribution.

CHAPTER IV

RESULTS

Patients and demographic data

This study included 211 elderly Thais. There were 102 male patients (48.3%) and 109 female patients (51.7%). Divided from age group, there were three age groups including 84 whose ages ranged from 60 to 64 years old (39.8%); 66 whose ages ranged from 65 to 69 years old (31.3%); and 61 whose ages were 70 years old or above (28.9%). The average ages of male and female patients were 66.71 ± 5.518 years and 67.54 ± 5.911 years, respectively.

The sample consisted of 162 patients who had systemic disease (76.8%) and 49 patients who did not have the disease (23.2%). There were 159 geriatric patients who took current medication (75.4%), while the other 52 did not (24.6%).

Patients and habitual data

This study collected three types of oral habits including smoking, alcoholic beverage drinking and areca nut chewing. Of 211 patients, there were 179 patients who did not have any oral habit (84.8%); 24 patients who had one oral habit (11.3%); 7 patients who had two oral habits (3.3%); and the other one patient who had all three oral habits (0.5%). For those patients with only one habit, they were divided into three groups including 6 patients who smoked (2.8%), 11 patients who drank (5.2%) and 7 patients who chewed areca nut (3.3%). For patients with two habits, the shared habits were smoking and alcoholic beverage consuming. There was only 1 patient who had all three habits (0.5%). The distribution of the oral habits which patients had was demonstrated in the **Figure 5.**

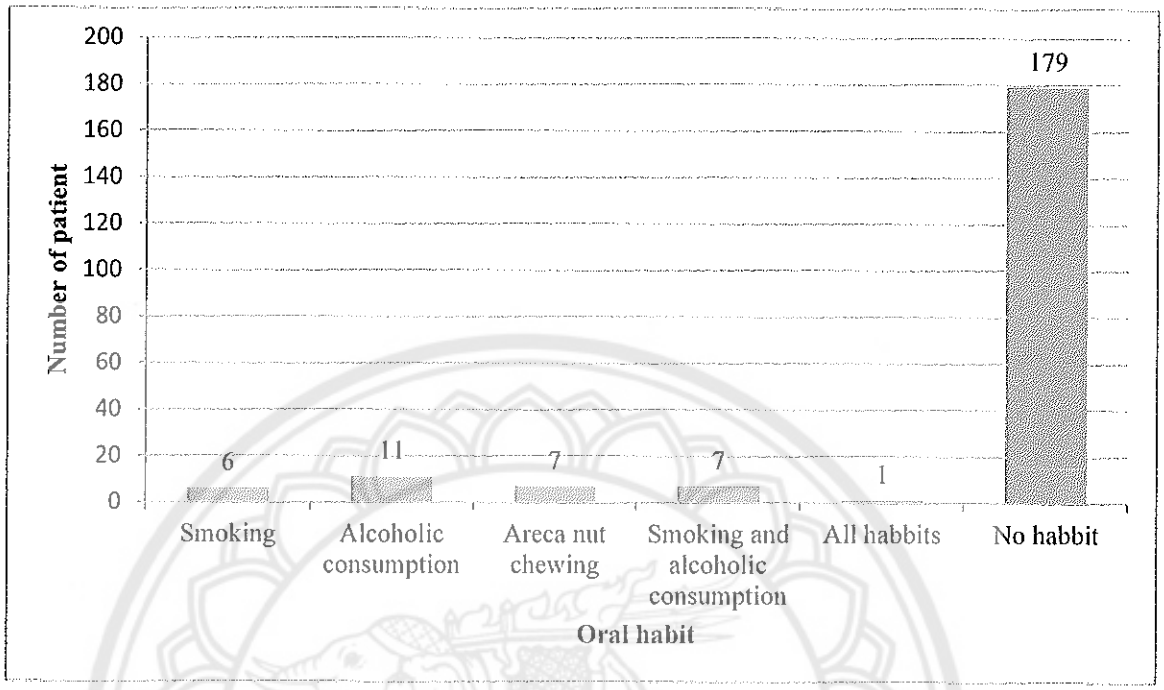

Figure 5 Number of oral habits patients had

Patients and denture data

Attributed to denture wearing, there were 143 patients who did not wear denture (67.8%); 42 patients wore only removable denture (19.9%); 20 patients wore only fixed denture (9.5%); and the other 6 patients wore both removable and fixed denture (2.8%).

Of 48 patients who wore removable denture, there were 24 patients who had good-retention denture (50%) and the other 24 had poor-retention denture (50%). Merely 29 patients had good denture stability (60.4%) while the other 19 had poor one (39.6%). Moreover, there were 23 patients who had good-fitting denture (47.9%) and 25 had ill-fitting denture (52.1%). Attributed to denture hygiene, there were 24 patients with good denture hygiene (50.0%), 18 patients with fair denture hygiene (37.5%) and 6 patients with poor denture hygiene (12.5%). There were 17 patients who wore removable denture overnight (35.4%) and the other 31 put off during the night (64.6%).

The Prevalence of oral mucosal lesions

From a total of 211 patients, there were 82 patients who had no oral mucosal lesion while the other 129 (61.1%) had at least one oral mucosal lesion. In the present study, oral mucosal lesions were classified into 8 groups including oral infection, autoimmune disease, epithelial pathology, vascular lesion, pigmented lesion, exophytic lesion, mucosal injury and other.

For oral infection group, there were 24 patients included to this group (11.4%). There was merely one type of infection which was fungal infection, mainly *Candida species.* The lesions found were including oral candidiasis – pseudomembranous type and erythematous type; angular cheilitis; and Candida associated denture induced stomatitis. Picture of some lesions in this group which were allowed from patients to take a photo, were showed in **Figure 7-10**.

For immune mediated lesion, this study consisted of 19 patients (9.0%) including 3 of recurrent aphthous ulcer (1.4%); 13 of oral lichen planus (6.2%); 2 of mucous membrane pemphigoid (0.9%); and 1 with pemphigus vulgaris (0.5%). For recurrent aphthous ulcer, there was only one patient for each type. Picture of some lesions in this group which were allowed from patients to take a photo, were showed in **Figure 11-14**.

There were 8 patients who were put into "group of diseases which was classified as epithelial pathology" (3.8%). This group consisted of 4 different lesions including 3 of nicotinic stomatitis (1.4%); 4 of leukoplakia (1.4%), 1 of erythroleukoplakia (0.5%) and 2 of oral squamous cell carcinoma (0.9%). One patient had both erythroleukoplakia and also leukoplakia. Also, there was 1 patient who had nicotinic stomatitis together with leukoplakia. Picture of some lesions in this group which were allowed from patients to take a photo, were showed in **Figure 15-17**.

There were 11 patients included into vascular lesion group. Ten of them had blood extravasation (4.7%) – petechiae or purpura; and 1 got vascular malformation (0.5%). Picture of some lesions in this group which were allowed from patients to take a photo, were showed in **Figure 18-19**.

For group of pigmented lesion, there consisted with 47 patients (22.3%). Since this study had conducted the lesions mainly from their clinical appearance, it could not really distinguish between each lesion–only suggestion could be made.

Picture of some lesions in this group which were allowed from patients to take a photo, were showed in **Figure 20-25**.

Exophytic lesions in this study were found in 8 patients (3.7%). Four of them were denture-induced fibrous inflammatory hyperplasia (1.9%), 2 of them were fibroma (0.9%), 1 of them was mucocele (0.5%), and the other was pyogenic granuloma (0.5%). Picture of some lesions in this group which were allowed from patients to take a photo, were showed in **Figure 26-28**.

There were 51 patients who had mucosal injury (24.2%), however it composed 57, since one patient could have more than one lesion. The lesions in the present study came from three types of cause including mechanical injury, chemical injury and radiation cause. Lesions caused by mechanical injury were including 27 of traumatic ulcer (12.8%), 23 of frictional keratosis (10.9%) and 1 of chronic cheek biting (0.5%). Lesions caused by chemical injury were including 3 of epithelial desquamation (1.4%), 1 of mucosal burn (0.5%) and 1 of chemotherapy induced mucositis (0.5%). Lesion caused by radiation was radiation induced mucositis which was found in one patient (0.5%). Picture of some lesions in this group which were allowed from patients to take a photo, were showed in **Figure 29-31**.

For the rest of the lesion, there were lesions which could not be categorized into the abovementioned groups. Patients in this group were including 1 patient with areca nut stain mucosa (0.5%), 1 patient with mucosal inflammation from osteomyelitis (0.5%), 1 patient with hairy tongue (0.5%) and 4 patients with coated tongue (1.9%). Picture of some lesions in this group which were allowed from patients to take a photo, were showed in **Figure 32-34**.

Categorized from number of lesion, there were five groups including 82 patients who had no any oral mucosal lesion (38.9%), 91 patients who had one group of lesion (43.1%), 31 patients who had two groups of lesion (14.7%), 6 patients who had three groups of lesion (2.8%) and 1 patient who had four groups of lesion (0.5%).

Attributed to lesion location, there were 120 patients who had countable lesion (56.9%) and 10 patients who had lesion in multiple areas (4.7%). However, there were 196 lesions found since some patients had lesions in more than one area. For those single lesions, they can be found in several of regions of oral tissue: 20 at lip (9.5%), 7 at labial mucosa (3.3%); 51 at buccal mucosa (24.2%); 7 at lip commissure

(3.3%); 30 at palate (14.2%); 13 at gingiva (6.2%); 21 at tongue (10.0%); 1 at floor of mouth (0.5%); 35 at alveolar ridge (16.6%); and 11 at oral vestibule (5.2%). The distribution of location of lesions was showed in **Figure 6**.

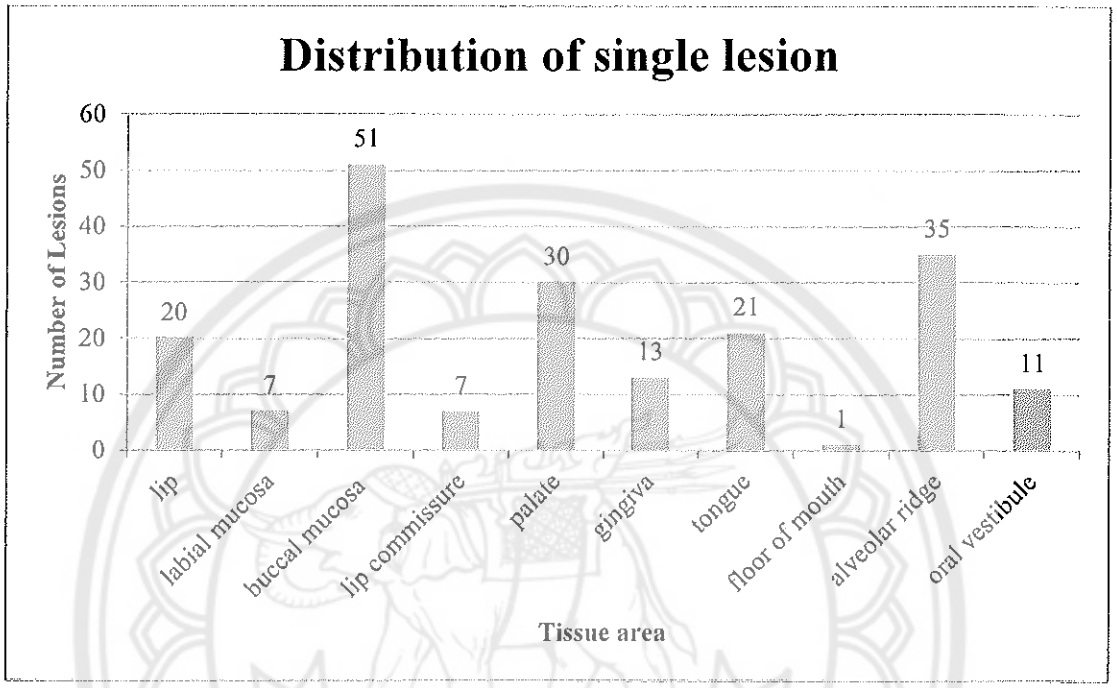

Figure 6 The distribution of single lesion

Attributed to age group, the patients were divided into three groups. The distribution between number of lesion, group of lesion and age group were demonstrated in **Table 2**. The number of patients who had at least one oral mucosal lesion in those who were 60-64 years old, 65-69 years old and 70 years old or above were 48 (22.7%), 40 (19.%) and 41 (19.4%), respectively.

The distribution between number of lesion, group of lesion and gender was demonstrated in **Table 3**. Sixty-six male patients had at least one oral mucosal lesion (31.3%). For female group, there were 63 patients had at oral mucosal lesion (29.9%).

The distribution between number of lesion, group of lesion and systemic disease was illustrated in **Table 4**. The number of patients who had at least one oral mucosal lesion in those who had systemic disease was 99 (46.9%) while those who did not had systemic disease was 30 (14.2%)

This study divided patients from their history of taking medicine into two groups which including those who took and those who did not take medicine. The distribution between number of lesion, group of lesion and current medication usage was shown in **Table 5**. Ninety-four patients who took medicine had oral lesion (44.5%) and there were 35 patients who did not take medicine and had oral lesions (16.6%).

The distribution between number of lesion, group of lesion and oral habits was showed in **Table 6**. The majority of patients in this study were the ones who had no oral habit. For those who had two oral habits, there were only patients who smoke together with drank alcoholic beverage. There was neither who smoke and chewed areca nut; nor who chewed areca nut and drank alcoholic beverage.

For denture wearing, the distribution of it with number of lesion and group of lesion was illustrated in **Table 7**. There were 47 patients who wore denture and had oral lesions (22.3%) and 82 patients who did not wear denture had oral lesions (38.7%).

In the present study, by using Pearson Chi-square, there was no association found between the prevalence between oral mucosal lesion to both age group ($P = 0.619$) and gender ($P = 0.371$).

Table 2 Distribution between number of lesion, group of lesion and age group

Number of lesions	60-64 years old (n%)	65-69 years old (n%)	70 years old or above (n%)	Total (n%)
No lesion	**35 (16.6)**	**24 (11.4)**	**23 (10.9)**	**82 (38.9)**
One lesion	**35 (16.6)**	**28 (13.3)**	**28 (13.3)**	**91 (43.1)**
1. Infection	5 (2.4)	6 (2.8)	4 (1.9)	15 (7.1)
2. Autoimmune disease	8 (3.8)	3 (1.4)	3 (1.4)	14 (6.6)
3. Epithelial pathology	1 (0.5)	1 (0.5)	3 (1.4)	5 (2.4)
4. Pigmented lesion	9 (4.3)	9 (4.3)	6 (2.8)	24 (11.3)
5. Injury	8 (3.8)	7 (3.3)	9 (4.3)	24 (11.3)
6. Vascular lesion	1 (0.5)	1 (0.5)	1 (0.5)	3 (1.4)
7. Exophytic lesion	1 (0.5)	0 (0.0)	1 (0.5)	2 (0.9)
8. Other	2 (0.9)	1 (0.5)	1 (0.5)	4 (1.9)
Two lesions	**10 (4.7)**	**10 (4.7)**	**11 (5.2)**	**31 (14.7)**
1. Infection with injury	0 (0.0)	2 (0.9)	1 (0.5)	3 (1.4)
2. Infection with exophytic lesion	0 (0.0)	0 (0.0)	1 (0.5)	1 (0.5)
3. Infection with pigmented lesion	1 (0.5)	0 (0.0)	0 (0.0)	1 (0.5)
4. Infection with autoimmune disease	0 (0.0)	0 (0.0)	1 (0.5)	1 (0.5)
5. Autoimmune disease with injury	1 (0.5)	0 (0.0)	1 (0.5)	2 (0.9)
6. Autoimmune disease with pigmented lesion	0 (0.0)	1 (0.5)	1 (0.5)	2 (0.9)
7. Vascular lesion with pigmented lesion	3 (1.4)	0 (0.0)	1 (0.5)	4 (1.9)
8. Vascular lesion with injury	0 (0.0)	1 (0.5)	1 (0.5)	2 (0.9)
9. Pigmented lesion with Injury	4 (1.9)	4 (1.9)	3 (1.4)	11 (5.2)
10. Pigmented lesion with exophytic lesion	0 (0.0)	1 (0.5)	0 (0.0)	1 (0.5)
11. Epithelial pathology with exophytic lesion	1 (0.5)	0 (0.0)	0 (0.0)	1 (0.5)
12. Exophytic lesion with injury	0 (0.0)	1 (0.5)	1 (0.5)	2 (0.9)
Three lesions	**3 (1.4)**	**2 (0.9)**	**1 (0.5)**	**6 (2.8)**
1. Infection with injury and exophytic lesion	0 (0.0)	0 (0.0)	1 (0.5)	1 (0.5)
2. Infection with epithelial pathology and injury	0 (0.0)	1 (0.5)	0 (0.0)	1 (0.5)
3. Vascular lesion with pigmented lesion and injury	2 (0.9)	0 (0.0)	0 (0.0)	2 (0.9)
4. Pigmented lesion with injury and other	1 (0.5)	0 (0.0)	0 (0.0)	1 (0.5)
5. Epithelial pathology with injury and other	0 (0.0)	1 (0.5)	0 (0.0)	1 (0.5)
Four lesions	**0 (0.0)**	**0 (0.0)**	**1 (0.5)**	**1 (0.5)**
1. Infection, pigmented lesion, injury and other	0 (0.0)	0 (0.0)	1 (0.5)	1 (0.5)
Total	**83 (39.3)**	**64 (30.3)**	**64 (30.3)**	**211 (100)**

Table 3 Distribution between number of lesion, group of lesion and gender

Number of lesions	Male (n%)	Female (n%)	Total (n%)
No lesion	**36 (17.1)**	**46 (21.8)**	**82 (38.9)**
One lesion	**42 (19.9)**	**49 (23.2)**	**91 (43.1)**
1. Infection	6 (2.8)	9 (4.3)	15 (7.1)
2. Autoimmune disease	2 (0.9)	12 (5.7)	14 (6.6)
3. Epithelial pathology	2 (0.9)	3 (1.4)	5 (2.4)
4. Pigmented lesion	17 (8.1)	7 (3.3)	24 (11.3)
5. Injury	13 (6.2)	11 (5.2)	24 (11.3)
6. Vascular lesion	2 (0.9)	1 (0.5)	3 (1.4)
7. Exophytic lesion	0 (0.0)	2 (0.9)	2 (0.9)
8. Other	0 (0.0)	4 (1.9)	4 (1.9)
Two lesions	**20 (9.5)**	**11 (5.2)**	**31 (14.7)**
1. Infection with injury	1 (0.5)	2 (0.9)	3 (1.4)
2. Infection with exophytic lesion	0 (0.0)	1 (0.5)	1 (0.5)
3. Infection with pigmented lesion	0 (0.0)	1 (0.5)	1 (0.5)
4. Infection with autoimmune disease	0 (0.0)	1 (0.5)	1 (0.5)
5. Autoimmune disease with injury	1 (0.5)	1 (0.5)	2 (0.9)
6. Autoimmune disease with pigmented lesion	1 (0.5)	1 (0.5)	2 (0.9)
7. Vascular lesion with pigmented lesion	4 (1.9)	0 (0.0)	4 (1.9)
8. Vascular lesion with injury	2 (0.9)	0 (0.0)	2 (0.9)
9. Pigmented lesion with Injury	8 (3.8)	3 (1.4)	11 (5.2)
10. Pigmented lesion with exophytic lesion	1 (0.5)	0 (0.0)	1 (0.5)
11. Epithelial pathology with exophytic lesion	1 (0.5)	0 (0.0)	1 (0.5)
12. Exophytic lesion with injury	1 (0.5)	1 (0.5)	2 (0.9)
Three lesions	3 (1.4)	3 (1.4)	**6 (2.8)**
1. Infection with injury and exophytic lesion	0 (0.0)	1 (0.5)	1 (0.5)
2. Infection with epithelial pathology and injury	0 (0.0)	1 (0.5)	1 (0.5)
3. Vascular lesion with pigmented lesion and injury	2 (0.9)	0 (0.0)	2 (0.9)
4. Pigmented lesion with injury and other	1 (0.5)	0 (0.0)	1 (0.5)
5. Epithelial pathology with injury and other	0 (0.0)	1 (0.5)	1 (0.5)
Four lesions	**1 (0.5)**	**0 (0.0)**	**1 (0.5)**
1. Infection, pigmented lesion, injury and other	1 (0.5)	0 (0.0)	1 (0.5)
Total	**102 (48.3)**	**109 (51.7)**	**211 (100)**

Table 4 Distribution between number of lesion, group of lesion and systemic disease

Number of lesions	Have systemic disease (n%)	No systemic disease (n%)	Total (n%)
No lesion	**63 (29.9)**	**19 (9.0)**	**82 (38.9)**
One lesion	**70 (33.2)**	**21 (10.0)**	**91 (43.1)**
1. Infection	13 (6.2)	2 (0.9)	15 (7.1)
2. Autoimmune disease	10 (4.7)	4 (1.9)	14 (6.6)
3. Epithelial pathology	4 (1.9)	1 (0.5)	5 (2.4)
4. Pigmented lesion	17 (8.1)	7 (3.3)	24 (11.3)
5. Injury	20 (9.5)	4 (1.9)	24 (11.3)
6. Vascular lesion	3 (1.4)	0 (0.0)	3 (1.4)
7. Exophytic lesion	2 (0.9)	0 (0.0)	2 (0.9)
8. Other	1 (0.5)	3 (1.4)	4 (1.9)
Two lesions	**22 (10.4)**	**9 (4.3)**	**31 (14.7)**
1. Infection with injury	2 (0.9)	1 (0.5)	3 (1.4)
2. Infection with exophytic lesion	1 (0.5)	0 (0.0)	1 (0.5)
3. Infection with pigmented lesion	1 (0.5)	0 (0.0)	1 (0.5)
4. Infection with autoimmune disease	1 (0.5)	0 (0.0)	1 (0.5)
5. Autoimmune disease with injury	2 (0.9)	1 (0.5)	2 (0.9)
6. Autoimmune disease with pigmented lesion	2 (0.9)	0 (0.0)	2 (0.9)
7. Vascular lesion with pigmented lesion	3 (1.4)	1 (0.5)	4 (1.9)
8. Vascular lesion with injury	1 (0.5)	1 (0.5)	2 (0.9)
9. Pigmented lesion with Injury	8 (3.8)	2 (0.9)	11 (5.2)
10. Pigmented lesion with exophytic lesion	0 (0.0)	1 (0.5)	1 (0.5)
11. Epithelial pathology with exophytic lesion	0 (0.0)	1 (0.5)	1 (0.5)
12. Exophytic lesion with injury	1 (0.5)	1 (0.5)	2 (0.9)
Three lesions	**6 (2.8)**	**0 (0.0)**	**6 (2.8)**
1. Infection with injury and exophytic lesion	1 (0.5)	0 (0.0)	1 (0.5)
2. Infection with epithelial pathology and injury	1 (0.5)	0 (0.0)	1 (0.5)
3. Vascular lesion with pigmented lesion and injury	2 (0.9)	0 (0.0)	2 (0.9)
4. Pigmented lesion with injury and other	1 (0.5)	0 (0.0)	1 (0.5)
5. Epithelial pathology with injury and other	1 (0.5)	0 (0.0)	1 (0.5)
Four lesions	**1 (0.5)**	**0 (0.0)**	**1 (0.5)**
1. Infection, pigmented lesion, injury and other	1 (0.5)	0 (0.0)	1 (0.5)
Total	**162 (76.8)**	**49 (23.2)**	**211 (100)**

Table 5 Distribution between number of lesion, group of lesion and medication usage

Number of lesions	Have current medication (n%)	Have no current medication (n%)	Total (n%)
No lesion	**65 (30.8)**	**17 (8.1)**	**82 (38.9)**
One lesion	**67 (31.8)**	**24 (11.4)**	**91 (43.1)**
1. Infection	12 (5.7)	3 (1.4)	15 (7.1)
2. Autoimmune disease	11 (5.2)	3 (1.4)	14 (6.6)
3. Epithelial pathology	4 (1.9)	1 (0.5)	5 (2.4)
4. Pigmented lesion	15 (7.1)	9 (4.3)	24 (11.3)
5. Injury	20 (9.5)	4 (1.9)	24 (11.3)
6. Vascular lesion	3 (1.4)	0 (0.0)	3 (1.4)
7. Exophytic lesion	1 (0.5)	1 (0.5)	2 (0.9)
8. Other	1 (0.5)	3 (1.4)	4 (1.9)
Two lesions	**20 (9.5)**	**11 (5.2)**	**31 (14.7)**
1. Infection with injury	2 (0.9)	1 (0.5)	3 (1.4)
2. Infection with exophytic lesion	0 (0.0)	1 (0.5)	1 (0.5)
3. Infection with pigmented lesion	1 (0.5)	0 (0.0)	1 (0.5)
4. Infection with autoimmune disease	1 (0.5)	0 (0.0)	1 (0.5)
5. Autoimmune disease with injury	1 (0.5)	1 (0.5)	2 (0.9)
6. Autoimmune disease with pigmented lesion	3 (1.4)	0 (0.0)	2 (0.9)
7. Vascular lesion with pigmented lesion	3 (1.4)	1 (0.5)	4 (1.9)
8. Vascular lesion with injury	1 (0.5)	1 (0.5)	2 (0.9)
9. Pigmented lesion with Injury	7 (3.3)	3 (1.4)	11 (5.2)
10. Pigmented lesion with exophytic lesion	0 (0.0)	1 (0.5)	1 (0.5)
11. Epithelial pathology with exophytic lesion	0 (0.0)	1 (0.5)	1 (0.5)
12. Exophytic lesion with injury	1 (0.5)	1 (0.5)	2 (0.9)
Three lesions	**6 (2.8)**	**0 (0.0)**	**6 (2.8)**
1. Infection with injury and exophytic lesion	1 (0.5)	0 (0.0)	1 (0.5)
2. Infection with epithelial pathology and injury	1 (0.5)	0 (0.0)	1 (0.5)
3. Vascular lesion with pigmented lesion and injury	2 (0.9)	0 (0.0)	2 (0.9)
4. Pigmented lesion with injury and other	1 (0.5)	0 (0.0)	1 (0.5)
5. Epithelial pathology with injury and other	1 (0.5)	0 (0.0)	1 (0.5)
Four lesions	**1 (0.5)**	**0 (0.0)**	**1 (0.5)**
1. Infection, pigmented lesion, injury and other	1 (0.5)	0 (0.0)	1 (0.5)
Total	**159 (75.4)**	**52 (24.6)**	**211 (100)**

Table 6 Distribution between number of lesion, group of lesion and oral habits

Number of lesions	No habit (n%)	Smoking (n%)	Alcoholic drinking (n%)	Areca nut chewing (n%)	Smoking & Drinking (n%)	all habits (n%)	Total (n%)
No lesion	**74 (35.1)**	**1 (0.5)**	**5 (2.4)**	**2 (0.9)**	**0 (0.0)**	**0 (0.0)**	**82 (38.9)**
One lesion	**76 (36.0)**	**2 (0.9)**	**6 (2.8)**	**3 (1.4)**	**4 (1.9)**	**0 (0.0)**	**91 (43.1)**
1. Infection	14 (6.6)	0 (0.0)	0 (0.0)	1 (0.5)	0 (0.0)	0 (0.0)	15 (7.1)
2. Autoimmune disease	14 (6.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	14 (6.6)
3. Epithelial pathology	4 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	5 (2.4)
4. Pigmented lesion	18 (8.5)	2 (0.9)	2 (0.9)	0 (0.0)	3 (1.4)	0 (0.0)	24 (11.3)
5. Injury	20 (9.5)	0 (0.0)	3 (1.4)	0 (0.0)	1 (0.5)	0 (0.0)	24 (11.3)
6. Vascular lesion	2 (0.9)	0 (0.0)	1 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	3 (1.4)
7. Exophytic lesion	2 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.9)
8. Other	2 (0.9)	0 (0.0)	0 (0.0)	2 (0.9)	0 (0.0)	0 (0.0)	4 (1.9)
Two lesions	**26 (12.3)**	**1 (0.5)**	**0 (0.0)**	**1 (0.5)**	**2 (0.9)**	**1 (0.5)**	**31 (14.7)**
1. Infection with injury	2 (0.9)	0 (0.0)	0 (0.0)	1 (0.5)	0 (0.0)	0 (0.0)	3 (1.4)
2. Infection with exophytic lesion	1 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)
3. Infection with pigmented lesion	1 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)
4. Infection with autoimmune disease	1 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)
5. Autoimmune disease with injury	2 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.9)
6. Autoimmune disease with pigmented lesion	2 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.9)
7. Vascular lesion with pigmented lesion	4 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (1.9)
8. Vascular lesion with injury	2 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.9)
9. Pigmented lesion with Injury	9 (4.2)	1 (0.5)	0 (0.0)	0 (0.0)	1 (0.5)	0 (0.0)	11 (5.2)
10. Pigmented lesion with exophytic lesion	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)	0 (0.0)	1 (0.5)
11. Epithelial pathology with exophytic lesion	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)	1 (0.5)
12. Exophytic lesion with injury	2 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.9)

Table 6 (cont.)

Number of lesions	No habit (n%)	Smoking (n%)	Alcoholic drinking (n%)	Areca nut (n%)	Smoking and Alcoholic drinking (n%)	Have all habits (n%)	Total (n%)
Three lesions	**2 (0.9)**	**2 (0.9)**	**0 (0.0)**	**1 (0.5)**	**1 (0.5)**	**0 (0.0)**	**6 (2.8)**
1. Infection with injury and exophytic lesion	1 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)
2. Infection with epithelial pathology and injury	1 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)
3. Vascular lesion with pigmented lesion and injury	0 (0.0)	2 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.9)
4. Pigmented lesion with injury and other	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)	0 (0.0)	1 (0.5)
5. Epithelial pathology with injury and other	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)
Four lesions	**1 (0.5)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**1 (0.5)**
1. Infection, pigmented lesion, injury and other	1 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)
Total	179 (84.8)	6 (2.8)	11 (5.2)	7 (3.3)	7 (3.3)	1 (0.5)	**211 (100)**

Table 7 Distribution between number of lesion, group of lesion and denture wearing

Number of lesions	Have denture (n%)	Do not have denture (n%)	Total (n%)
No lesion	**21 (10.0)**	**61 (28.9)**	**82 (38.9)**
One lesion	**32 (15.2)**	**59 (28.0)**	**91 (43.1)**
1. Infection	10 (4.7)	5 (2.4)	15 (7.1)
2. Autoimmune disease	3 (1.4)	11 (5.2)	14 (6.6)
3. Epithelial pathology	0 (0.0)	5 (2.4)	5 (2.4)
4. Pigmented lesion	5 (2.4)	19 (9.0)	24 (11.3)
5. Injury	10 (4.7)	14 (6.6)	24 (11.3)
6. Vascular lesion	2 (0.9)	1 (0.5)	3 (1.4)
7. Exophytic lesion	1 (0.5)	1 (0.5)	2 (0.9)
8. Other	1 (0.5)	3 (1.4)	4 (1.9)
Two lesions	**11 (5.2)**	**20 (9.5)**	**31 (14.7)**
1. Infection with injury	1 (0.5)	2 (0.9)	3 (1.4)
2. Infection with exophytic lesion	1 (0.5)	0 (0.0)	1 (0.5)
3. Infection with pigmented lesion	1 (0.5)	0 (0.0)	1 (0.5)
4. Infection with autoimmune disease	0 (0.0)	1 (0.5)	1 (0.5)
5. Autoimmune disease with injury	0 (0.0)	2 (0.9)	2 (0.9)
6. Autoimmune disease with pigmented lesion	0 (0.0)	2 (0.9)	2 (0.9)
7. Vascular lesion with pigmented lesion	1 (0.5)	3 (1.4)	4 (1.9)
8. Vascular lesion with injury	0 (0.0)	2 (0.9)	2 (0.9)
9. Pigmented lesion with Injury	4 (1.9)	7 (3.3)	11 (5.2)
10. Pigmented lesion with exophytic lesion	0 (0.0)	1 (0.5)	1 (0.5)
11. Epithelial pathology with exophytic lesion	1 (0.5)	0 (0.0)	1 (0.5)
12. Exophytic lesion with injury	1 (0.5)	0 (0.0)	2 (0.9)
Three lesions	**3 (1.4)**	**3 (1.4)**	**6 (2.8)**
1. Infection with injury and exophytic lesion	0 (0.0)	1 (0.5)	1 (0.5)
2. Infection with epithelial pathology and injury	0 (0.0)	1 (0.5)	1 (0.5)
3. Vascular lesion with pigmented lesion and injury	0 (0.0)	1 (0.5)	2 (0.9)
4. Pigmented lesion with injury and other	1 (0.5)	0 (0.0)	1 (0.5)
5. Epithelial pathology with injury and other	1 (0.5)	0 (0.0)	1 (0.5)
Four lesions	**1 (0.5)**	**0 (0.0)**	**1 (0.5)**
1. Infection, pigmented lesion, injury and other	1 (0.5)	0 (0.0)	1 (0.5)
Total	**68 (32.2)**	**143 (67.8)**	**211 (100)**

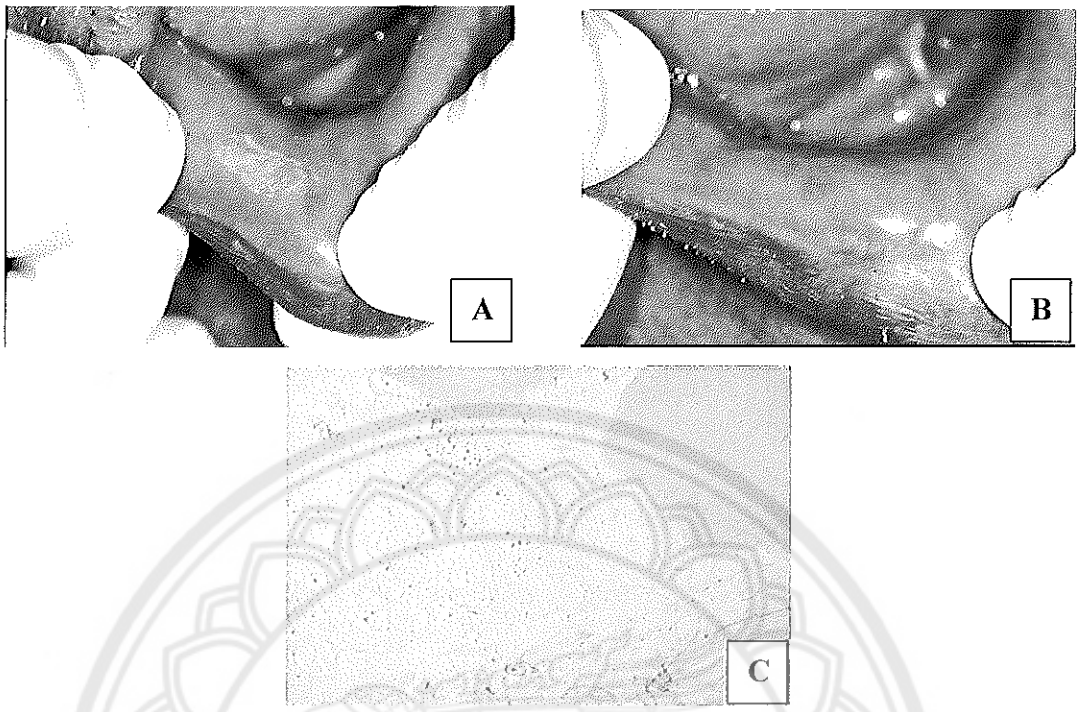

Figure 7 Infection: pseudomembranous candidiasis in 69-year-old male patient: A–before rubbing; B–after rubbed off; and C–hyphae of *Candida*

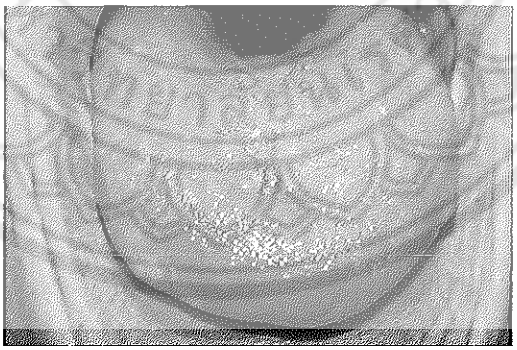

Figure 8 Infection group: erythematous candidiasis in 78-year-old female patient

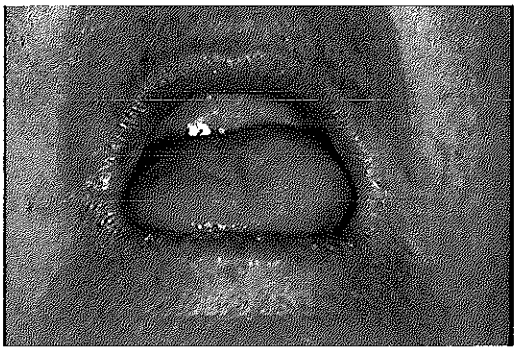

Figure 9 Infection group: angular cheilitis at right and left lip commissure in 66-year-old female patient

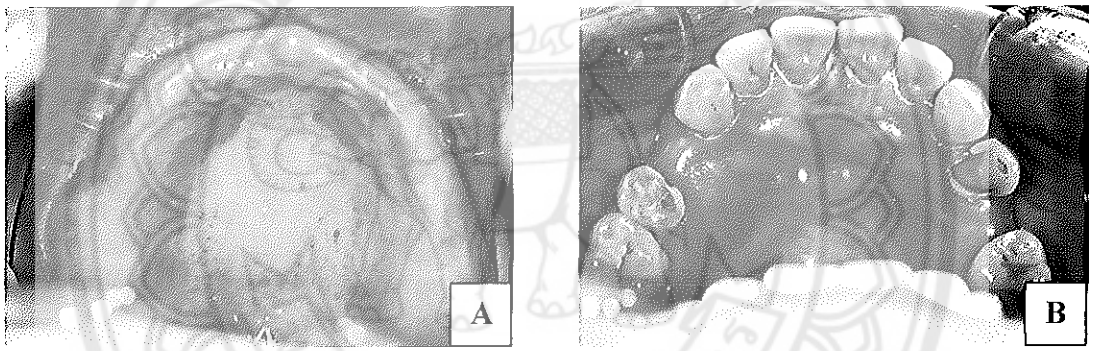

Figure 10 Infection group: *Candida* associated denture induced stomatitis: A–Grade I in 63-year-old female patient; and B–Grade III in 61-year-old male patient

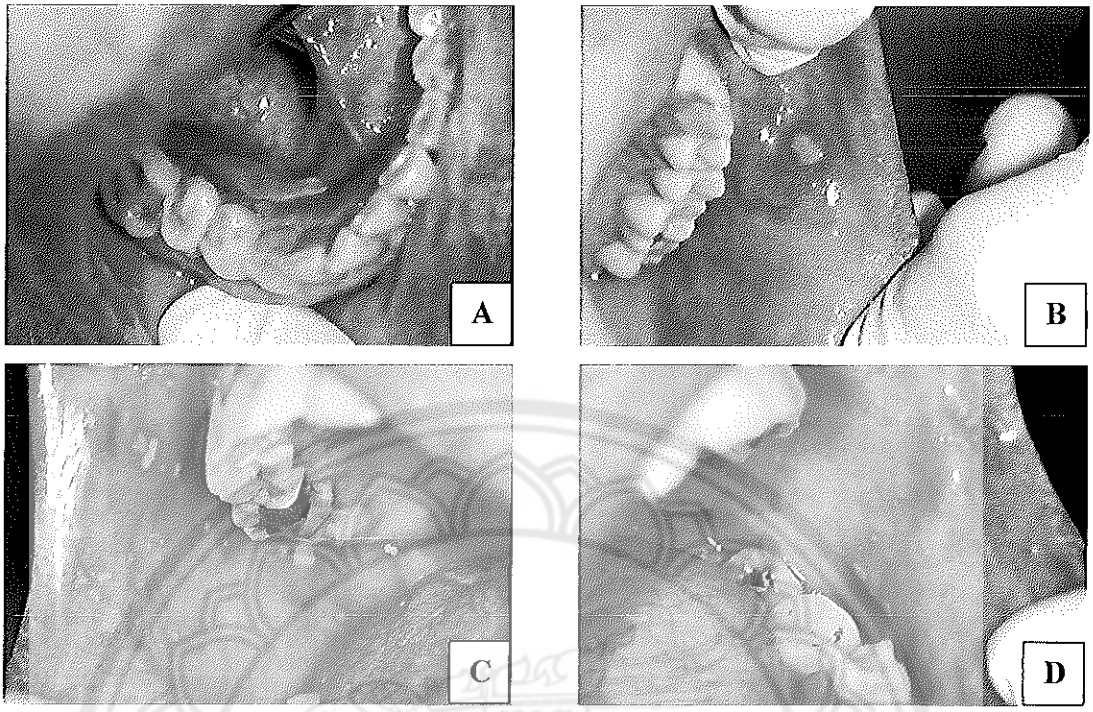

Figure 11 Autoimmune disease: three types of aphthous ulcer: A–major aphthous ulcer at right lingual alveolar ridge in 68-year-old female patient; B-minor aphthous ulcer at left buccal mucosa in 78-year-old male patient; and C&D–herpetiform aphthous ulcer present at buccal mucosa in generalize in 60-year-old male patient

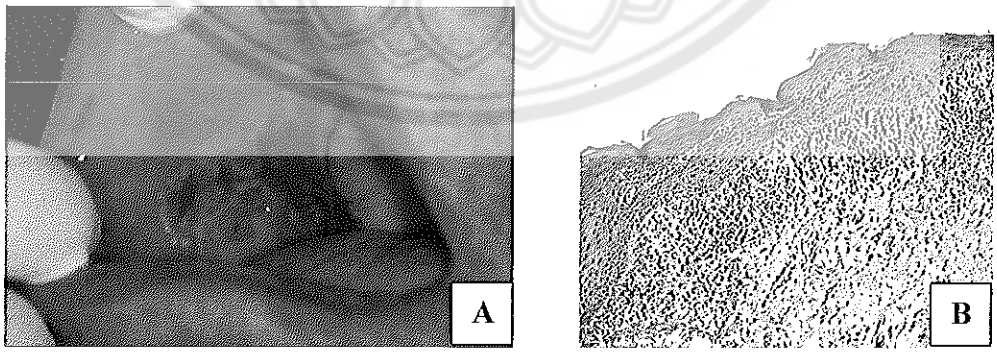

Figure 12 Autoimmune disease: oral lichen planus in 69-year-old female patient: A– erythematous area with white striae at right buccal mucosa; and B– histopathologic result found lymphocytic band at below the epithelium.

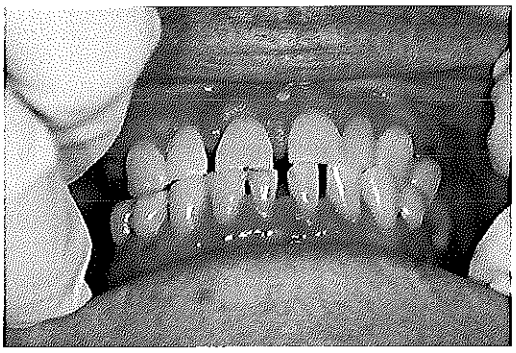

Figure 13 Autoimmune disease: mucous membrane pemphigoid which present as ulcer at gingiva (area of tooth 12) after rupturing of blister in 63-year-old female patient

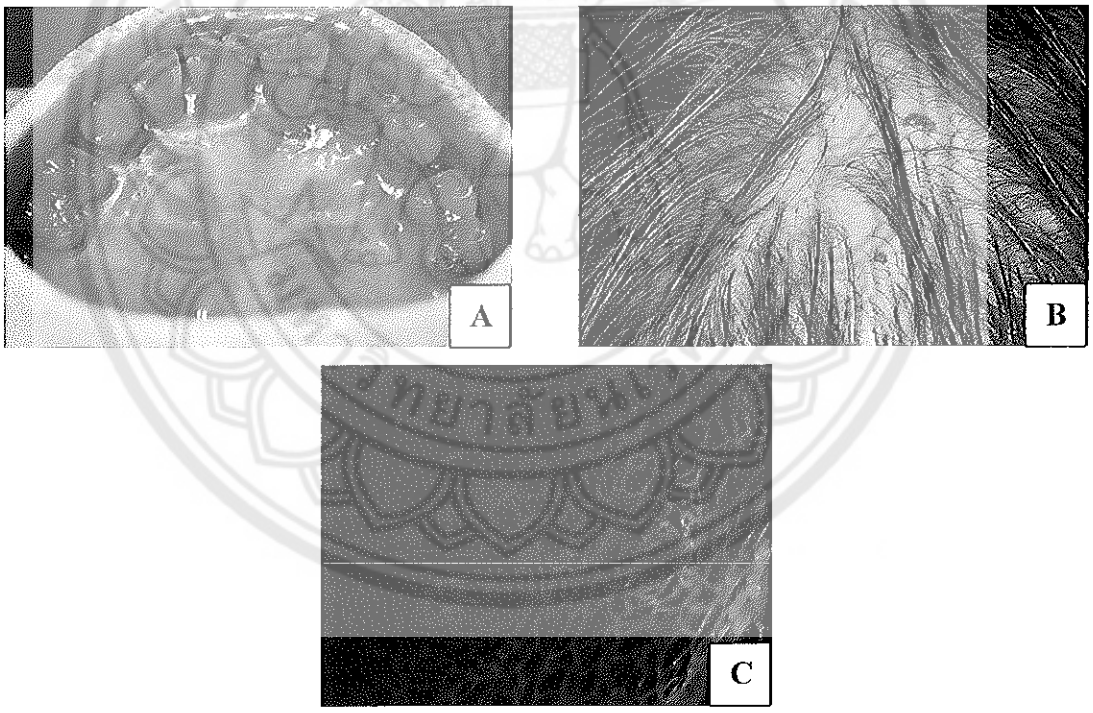

Figure 14 Autoimmune disease: pemphigus vulgaris in 62-year-old female patient: A–desquamative gingivitis; B; ulcer which subsequent from blister rupture at scalp; and C–direct immunofluorescent (DIF) found deposition of IgG at intercellular bridge, desmoglein

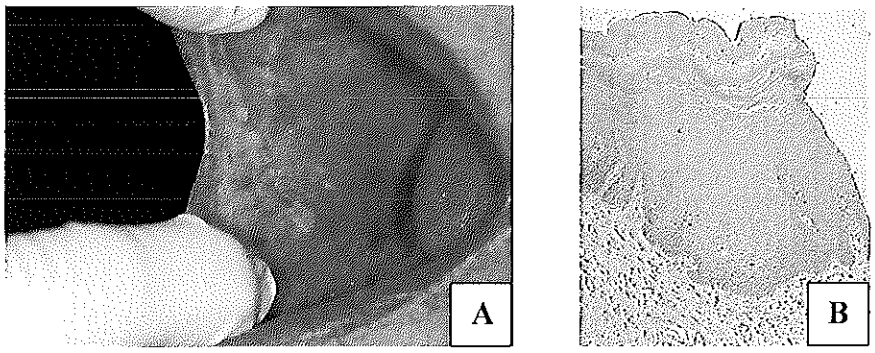

Figure 15 Epithelial pathology: leukoplakia in 66-year-old female patient:
A–white plaque at right retro-commissure mucosa; and
B–histopathologic examination showed acanthosis and hyperkeratosis

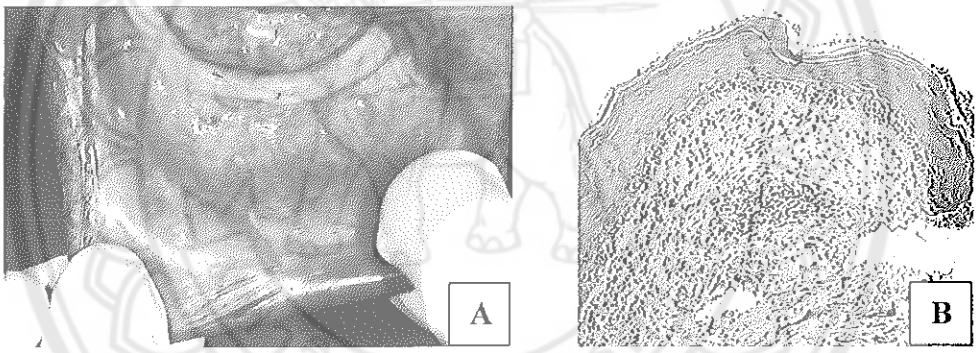

Figure 16 Epithelial pathology: erythroleukoplakia in 66-year-old female patient: A–red and white plaque at lower labial mucosa; and
B–histopathologic examination resulted as mild epithelial dysplasia

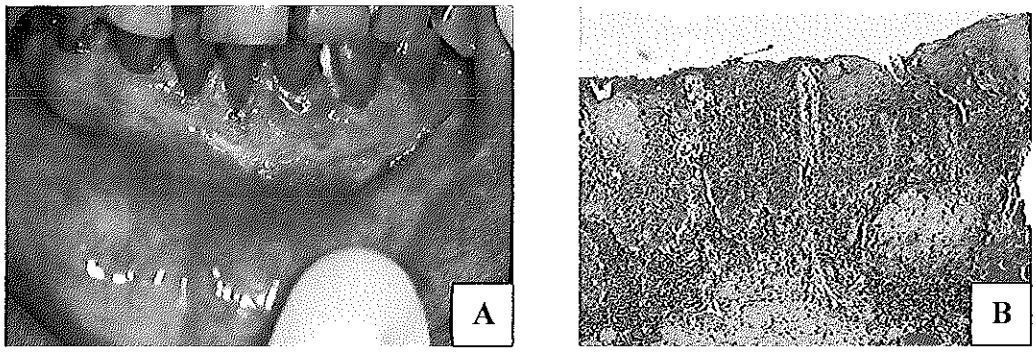

Figure 17 Epithelial pathology: squamous cell carcinoma in 87-year-old female patient: A–white verrucous-surface plaque at lower gingiva; and B–histopathologic examination demonstrated polymorphic epithelial cell which invade to underlining connective tissue

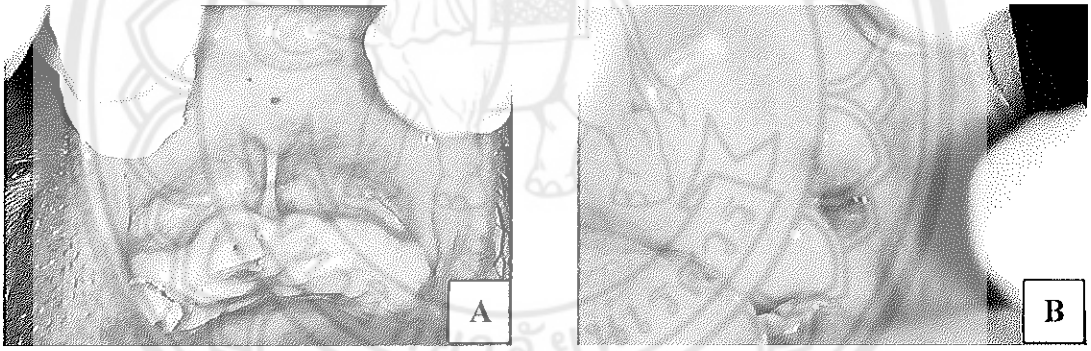

Figure 18 Vascular lesion: blood extravasation in two patients: A–Petechiae at upper labial mucosa in 60-year-old male patient; and B–Purpura at right buccal mucosa in 78-year-old male patient

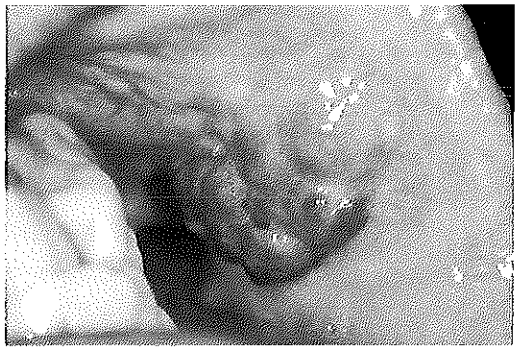

Figure 19 Vascular lesion: vascular malformation at right buccal mucosa in 63-year-old male patient

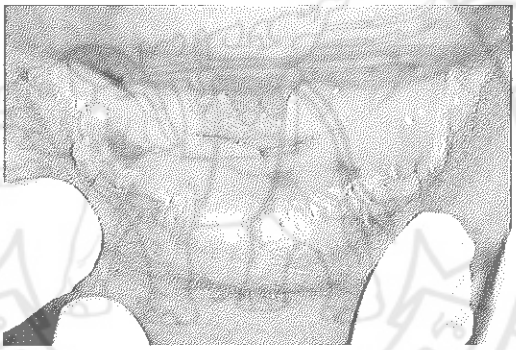

Figure 20 Pigmented lesion: suggested as melanotic macules at lower labial mucosa in 61-year-old female patient

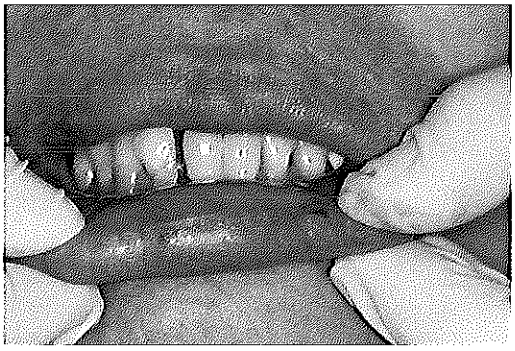

Figure 21 Pigmented lesion: suggested as melanocytic nevi at lower lip in 63-year-old female patient

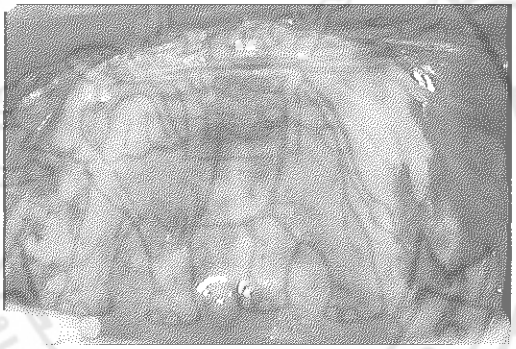

Figure 22 Pigmented lesion: suggested as drug-induced melanosis (in generalized) in 75-year-old male patient

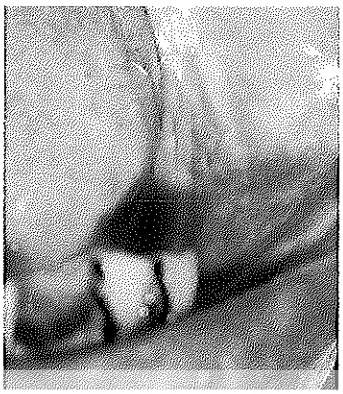

Figure 23 Pigmented lesion: suggested as amalgam tattoo at lower left alveolar ridge in 80-year-old male patient

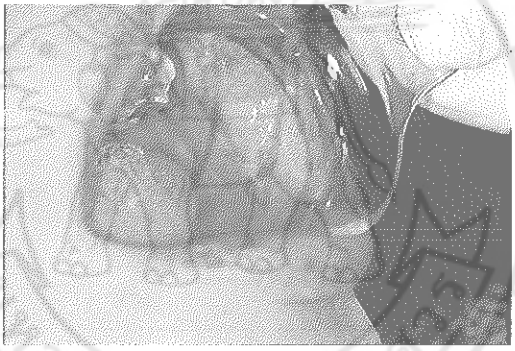

Figure 24 Pigmented lesion: suggested as post-inflammatory hyperpigmentation at left buccal mucosa surrounded by white striae of oral lichen planus in 78-year-old female patient

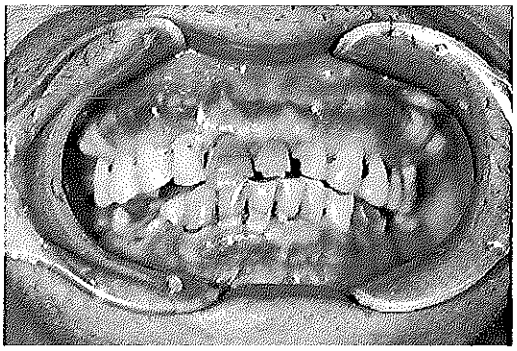

Figure 25 Pigmented lesion: suggested as smoker's melanosis in 64-year-old male patient

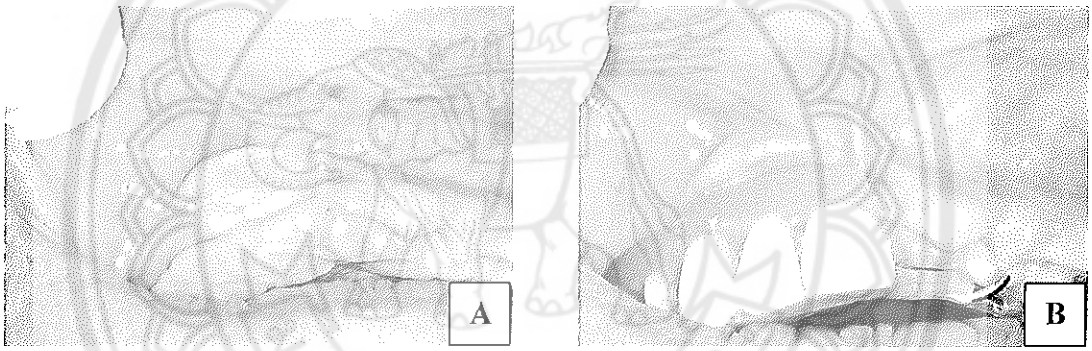

Figure 26 Exophytic lesion: denture-induced fibrous inflammatory hyperplasia at upper vestibule in 75-year-old male patient

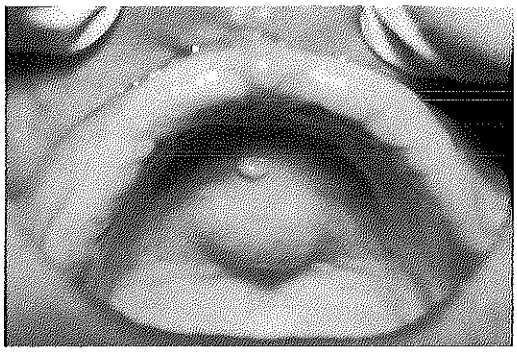

Figure 27 Exophytic lesion: fibroma on top of torus palatinus in 63-year-old male patient

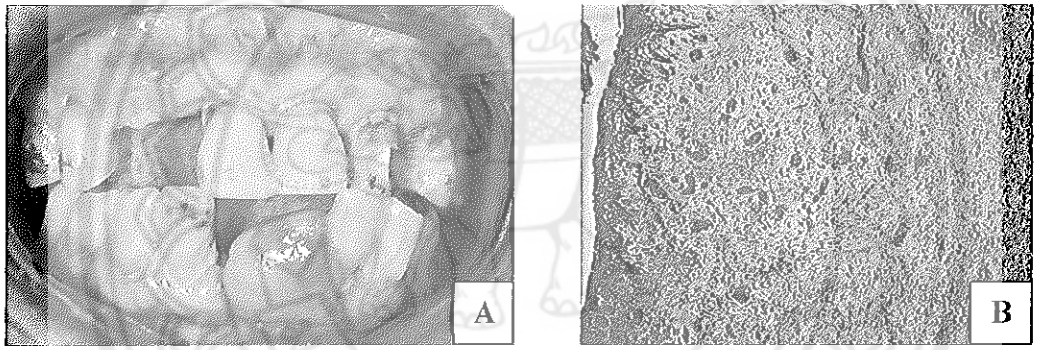

Figure 28 Exophytic lesion: pyogenic granuloma in 75-year-old female patient: A–erythematous, firm consistency mass at lower alveolar ridge; and B–histopathologic examination illustrated numerous of blood vessels and chronic inflammatory cell infiltration

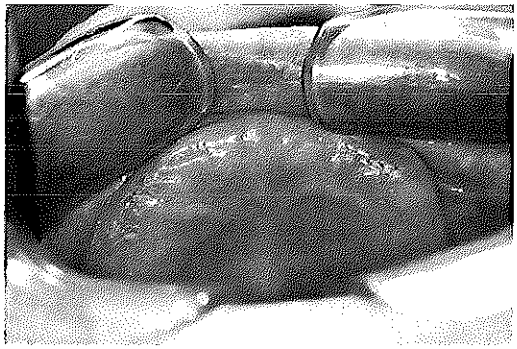

Figure 29 Injury group: traumatic ulcer at upper alveolar ridge in 77-year-old female patient

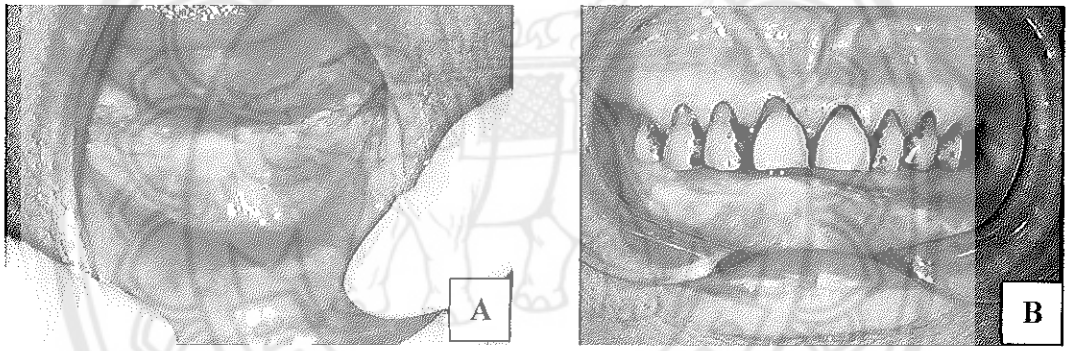

Figure 30 Injury group: frictional keratosis in 80-year-old female patient: A–white plaque at lower alveolar ridge; and B–upper teeth occluded to the opposing alveolar ridge and causing lesion

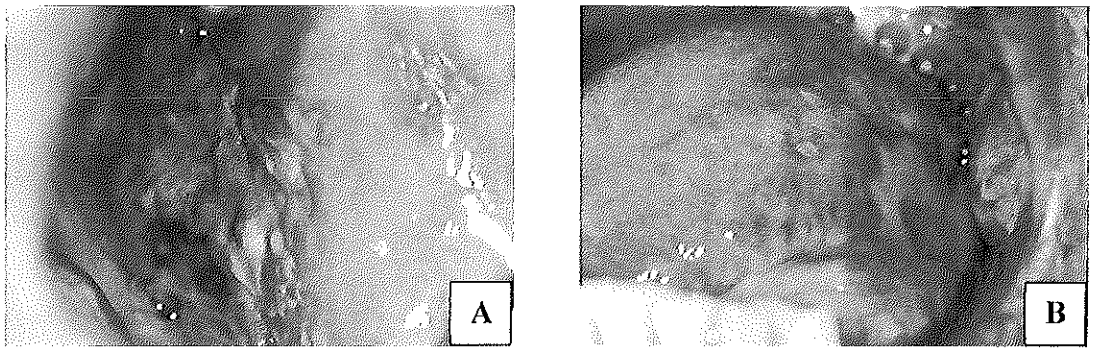

Figure 31 Injury group: radiation induced mucositis in 66-year-old male patient: A–ulcer at left buccal mucosa; and B–ulcer at left lateral of tongue

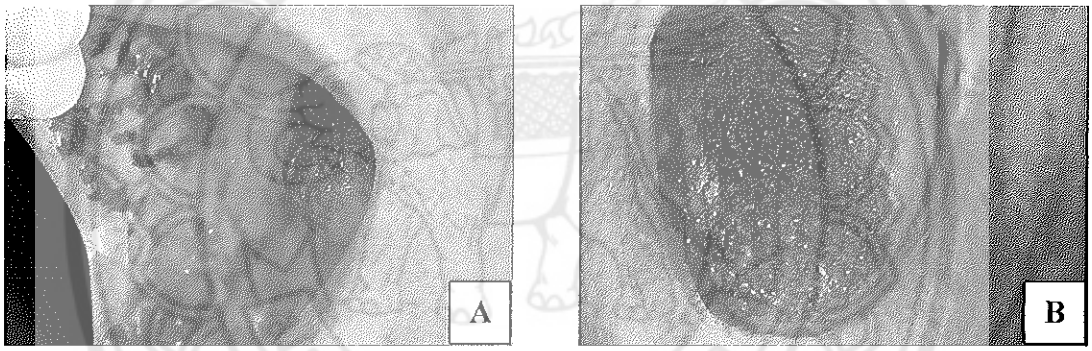

Figure 32 Group of other: areca nut stain in 66-year-old female patient: A–at right buccal mucosa; and B–at tongue

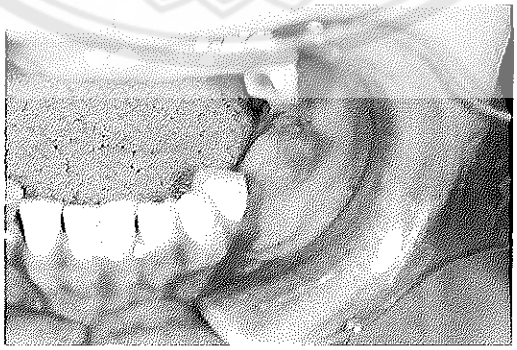

Figure 33 Group of other: inflammatory gingiva from underlining osteomyelitis in 61-year-old female patient

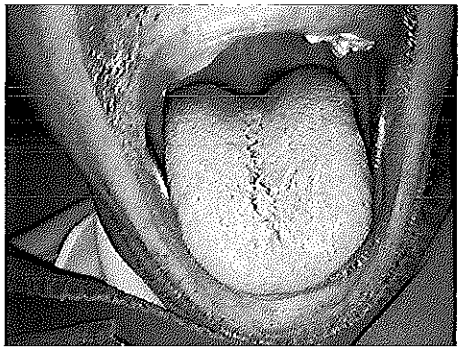

Figure 34 Group of other: hairy tongue in 60-year-old male patient

CHAPTER V

DISCUSSION AND CONCLUSION

Discussion

Of 211 patients in this study, 61.1% were patients who had at least one group of oral mucosal lesions. Comparing with other geriatric epidemiological studies, our recorded prevalence was in the range of 44.2 to 83.6% (Jainkittivong, Aneksuk and Langlais, 2002; Espinoza et al., 2003; Paillaud et al., 2007; Mujica, Rivera, & Carrero, 2008; de Vasconcelos Carvalho et al., 2011; Cueto et al., 2013; Patil, Doni, & Maheshwari, 2015; Al-Maweri et al, 2015; Bakhshi et al., 2015; Patil, Doni, & Maheshwari, 2015; Santos et al., 2015; Qannam, & Bello, 2016; Saravani et al., 2016). Jainkittivong's study was the only study that was set in Thailand and it reported that there were 83.6% of patients who had at least one oral mucosal condition. Comparing with this study, the prevalence in our study was slightly low. The drop of number may be the result of different criteria of collection – Jainkittivong's study collected both normal variation and lesions, but this study collected only lesions.

The prevalence of oral mucosal lesion in the present study was the result of surveying the geriatric patients in the Naresuan University dental hospital. However, this percentage was likely to be higher than it should have been, since the study was set at the dental hospital which was a place where people who seek for the medical treatment come. Moreover, some of them came directly for chief complaint of oral mucosal lesion.

According to age group, the prevalence of lesions had the same distribution. No specific group of lesion was found the predominance among three age groups.

In this study, there were some group of lesions which were predominantly found among female including infection and autoimmune disease. There were 16 female patients who were in the group of oral infection whereas it was found in only 8 male patients. For group of autoimmune disease, it was found in 15 female patients while it was found in only 4 male patients. On the contrary, there was also the group of lesion which had higher prevalence among male. There were 35 male patients who were in the group of pigmented lesion whereas it was found in only 12 female patients.

For oral candidiasis, comparing with other study, the prevalence of this lesion was also preponderance among female. However, most study divided oral candidiasis into subtypes including pseudomembranous candidiasis; erythematous candidiasis; angular cheilitis; *Candida* associated denture induced stomatitis; atrophic glosititis; and median rhomboid glossitis. One patient may exhibit more than one form of oral candidiasis, so the prevalence reported was not as same as resulted in this study which did not divide the subtypes (Jainkittivong, Aneksuk, & Langlais, 2002; Paillaud et al., 2007; Cueto et al., 2013; Patil, Doni, & Maheshwari, 2015).

For autoimmune diseases, other studies revealed that their prevalence were also higher among female. Majority of lesion in this group was oral lichen planus which was 6.2% of total sample and most of them were female – 10 patients out of total 13 patients who had oral lichen planus. However it some studies demonstrated that it had no association with gender or also was higher in male (Gorouhi, Davari, & Fazel, 2014). The author suggests that this difference of result caused by the variation of place the study took – Asia, Europe and United States of America. When compared with the studies in the same continent, the present result went in the same direction with them that found the preponderance among female (Jainkittivong, Aneksuk, & Langlais, 2002). For other lesion in this group, the number of patients who exhibited lesions was not enough to see the predilection.

For pigmented lesion, with the same reason with oral candidiasis, the prevalence in other studies was not the same, since they divide into subtypes, but this study did not. Other studies revealed that, some lesion in this group had strong relation with gender– smoker's melanosis (Jainkittivong, Aneksuk, & Langlais, 2002), but some of them were not–amalgam tattoo and melanotic macule (Jainkittivong, Aneksuk, & Langlais, 2002; Cueto et al., 2013; Al-Maweri et al., 2015). Each lesion had their individual factor, so this study may not conclude the association in between.

Medical data collection also had limitation. Most of the patients visited dental hospital without medical chart, so the medical data used in this study came from interviewing. From the abovementioned, although every patient had passed the mini mental state examination and those patients who would give a confusing answer were excluded, type and number of disease/medicine may not be totally corrected. The data we received came a recalled memory.

In order to minimize the information bias, this study designed to collect merely "present" or "not present".

In addition, majority of the patients in this study did have systemic disease and currently used medicine. This result was similar with previous study which had reported that there were 64.3% of patients who had at least one systemic disease, whereas 35.7% were disease-free (Bakhshi et al, 2015). The higher number of this group caused a higher chance of having lesions at the same time. However, it could not be mentioned that this medical condition had nothing in relation to oral mucosal lesion. There was a study which reported the higher prevalence of oral pathologic lesion among those geriatric with systemic disease (Bakhshi et al, 2015). To clarify this suspicion, more details on type, number and combination of systemic disease/medicine should be collected and higher level of statistical analysis is required.

In this study, it was found that, in patients who had systemic disease, they had higher prevalence of all group of lesions comparing with those who did not have systemic disease. There were 2 groups of lesion which had high discrimination including group of pigmented lesion and group of injury. There were 36 patients with systemic disease who had pigmented lesion while it was found in merely 11 patients without systemic disease. There were 41 patients with systemic disease who had injury while it was found in merely 10 patients without systemic disease. However, this study cannot determine the association between types of systemic disease and the prevalence of oral mucosal lesion, as mentioned in above statement.

For patients who used medicine, they had higher prevalence of all group of lesions comparing with those who did not use. The highest discrimination of the prevalence between those who used and did not, were found in group of pigmented lesion and group of injury. There were 33 patients, using medicine, had pigmented lesion while it was found in merely 14 patients who did not use medicine. There were 40 patients with currently used medicine and also had injury while it was found in merely 11 for those who did not use. With the same reason with systemic disease, this study cannot determine the association between groups of medicine and the prevalence of oral mucosal lesion.

For oral habits, majority of the patients did not have any oral habits (84.8%). Surprisingly, the prevalence of oral mucosal lesion was higher in this group,

comparing with those who had at least one oral habit (4.4: 1). This data resulted from the higher number of patients in the group, so it is more likely to discover diseases. Although the chance of higher prevalence of the oral mucosal lesion can be described by above statement, it does not mean that having oral habits helps reducing that chance. It was found that those who had oral habit did have oral mucosal lesion and some of the lesions found were a serious one. For example, one of the areca nut chewers had oral squamous cell carcinoma.

In this study, the distribution lesion's prevalence among those patients who smoking; drinking alcoholic beverage; chewing areca nut; and doing both smoking and drinking alcoholic beverage were the same. No specific group of lesion was found the predominance among all habits. However, for group of those who had all three habits, it could not be compared with other groups since there was only one patient conducted.

In this study, there were 32.2% of denture wearers. According to proportion, there were 14 patients, out of 68 patients who wore denture, had oral infection (20.6%). The percentage was higher than patients who did not wear denture which conducted only 10 patients out of 143 patients (7.0%).

Some lesions found in the study were considered as removable-denture-related lesion. This group of lesions were including traumatic ulcer, frictional keratosis, *Candida* associated denture induced stomatitis, angular cheilitis, denture-induced fibrous inflammatory hyperplasia. This may related by the removable denture had more risk factor than fixed denture including percentage of soft tissue covering and denture fitting. From abovementioned, it was prone to cause oral mucosal lesions. However, although the denture data including denture type, denture stability, denture retention, denture hygiene and nocturnal denture wearing were collected for determining the association with these lesions, there was the limitation also.

Firstly, the location of lesion was collected without proving that the lesion was really caused by denture. For example, patients with removable denture who have traumatic ulcer from other causes would be noted as same as patient who have traumatic ulcer caused by the denture. Secondly, some lesion could be caused by other factor from denture such as angular cheilitis which could be caused by infection and malnutrition (Glick, 2015). Since this study collected the lesion only in the first visit,

whereas the laboratory testing came later, it could not add the deficiency status into data collecting sheet.

Although the diagnosis was following World Health Organization (1980) guideline, some lesions could not be given the definitive diagnosis. To decrease the information bias, the lesions were categorized into eight groups including oral infection, autoimmune disease, epithelial pathology, vascular lesion, pigmented lesion, exophytic lesion, mucosal injury and other. Since the study was designed as clinic-based manner, most lesions were diagnosed from its clinical appearance. Some lesions could be defined only from histopathologic examination, for example, pigmented lesion–smoker melanosis and melanotic macule. However these two lesions were not biopsied practically. Moreover, although the patient had the history of heavy smoking, it could not exactly deny "melanotic macule" as the diagnosis since this smoker could have it before smoking either. From this reason, those brown macule was grouped as pigmented lesion.

Group of diseases which was classified as epithelial pathology in this study included nicotinic stomatitis, leukoplakia, erythroleukoplakia and oral squamous cell carcinoma. Nicotinic stomatitis could be diagnosed from its clinical appearance and the history of smoking, but the rest could not. In this study, there were lesions which appeared as white or white-red lesion. After histopathologic examination was done, it was found that some lesions had dysplastic change or even malignant transformation. From this finding, the author suggested that when discovered white or white-red lesion which the cause could not be identified, the biopsy and histopathologic examination should always be done. As seen in this study, small lesion could also contain malignant cells either.

This study was the first study which determined the prevalence of oral mucosal lesions among the geriatric patients of the Lower Northern Thailand. Although the number of sample was calculated by using the percentage reported in Thai previous study (Jainkittivong, Aneksuk and Langlais, 2002), the sample number was quite low. This study found many types of lesion, but each of them had low prevalence, so this study could not determine the association between each of the lesions to the suspicious factors.

Conclusion

In the Naresuan University dental hospital, the prevalence of oral mucosal lesions among the geriatric characterized by having more types of lesion. Each of them has low prevalence.

Determining the association between the prevalence of oral mucosal lesions of geriatric patients could not be done since the number of sample who had lesion per each group was not enough for determining the association statistically or it would have high risk of bias. However, there were some group lesions which had higher prevalence among female, male, those who had systemic disease, and those who used medicine and those who wore denture proportionally.

Recommendation

Since, this study collected data from only 211 patients and the prevalence of lesions was low. The author recommends that further study should include more samples for more details.

The limitation of this study is due to the lack of data in socioeconomic status, status of malnutrition, hyposalivation, occlusal vertical dimension loss and type of denture damage. Moreover, medical conditions should be based on medical chart record only. Further study with this data would help clarifying more on picture of oral mucosal lesions among the geriatric.

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APPENDIX

Data collecting form

Date..... **Code**.....

Birth date: .....
☐ 60-64 years ☐ 65-69 years ☐ 70-74 years ☐ 75-79 years ☐ 80 years or above
Gender: ☐ Male ☐ Female **Living province:** .....

Medical History: ☐ None
☐ Hypertension ☐ Hypotension ☐ Heart disease ☐ Diabetes mellitus ☐ Lung disease
☐ Blood dyscrasia ☐ Liver disease ☐ Kidney disease ☐ Head and neck radiation therapy
☐ Cancer treatment ☐ Other.....

Current Medicine: ☐ None
☐ Antihypertensive ☐ Anti-diabetes ☐ Anti-lipidemia ☐ Drug associated hemostasis
☐ Antibiotic (>14 days) ☐ BDZ ☐ Steroid ☐ Anti-histamine
☐ Anti-arrhythmia ☐ Allergy..... ☐ Other.....

Oral Habit:
Smoking: ☐ Never ☐ Smoking ☐ Former smoking
Alcohol drinking: ☐ Never ☐ Alcohol drinking ☐ Former alcohol drinking
Areca nut chewing: ☐ Never ☐ Areca nut chewing ☐ Former chewing

Denture wearing: ☐None Denture age; Upper: ..... Lower: .....
☐ Upper arch ☐ CD ☐ TP ☐ Valplast ☐RPD ☐ Crown / Bridge ☐ Implant
Denture retention ☐ Good ☐ Poor Denture stability ☐ Good ☐ Poor
Denture hygiene ☐ Good ☐ Fair ☐ Poor Denture fitting ☐ Good-fitting ☐ Ill-fitting
☐ Lower arch ☐ CD ☐ TP ☐ Valplast ☐RPD ☐ Crown / Bridge ☐ Implant
Denture retention ☐ Good ☐ Poor Denture stability ☐ Good ☐ Poor
Denture hygiene ☐ Good ☐ Fair ☐ Poor Denture fitting ☐ Good-fitting ☐ Ill-fitting
☐ Put off overnight ☐ Wearing overnight

Condition: ☐ None
☐ Angular cheilitis ☐ Atrophic glossitis ☐ Foliate papillitis ☐ Hairy tongue
☐ Median rhomboid glossitis ☐ MMP ☐ Nicotinic stomatitis
☐ Pemphigus vulgaris ☐ Radiation therapy-induced oral mucositis
☐ Chemotherapy-induced oral mucositis

☐ Amalgam tattoo	at.....	☐ Aphthous ulcer	at.....
☐ Cyst.....	at.....	☐ Denture stomatitis	at.....
☐ Epulis fisuratum	at.....	☐ Erythroleukoplakia	at.....
☐ Erythroplakia	at.....	☐ Frictional keratosis	at.....
☐ Irritating fibroma	at.....	☐ Leukoplakia	at.....
☐ Lichen planus	at.....	☐ Lichenoid.....	at.....
☐ Mucocele	at.....	☐ Oral candidiasis	at.....
☐ Smoker's melanosis	at.....	☐ Traumatic ulcer	at.....
☐ Benign tumor.....	at.....	☐ Malignant tumor.....	at.....
☐ Other.....	at.....		

Clinician:
.....